VOLUME 49 NUMBER 1

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JANUARY 1949

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO 10, ILLINOIS. ANNUAL SUBSCRIPTION, $10.00

Entered as Second Class Matter Jan. 14, 1925, at the Postoffice at Chicago, Under the Act of Congress of March 3, 1879

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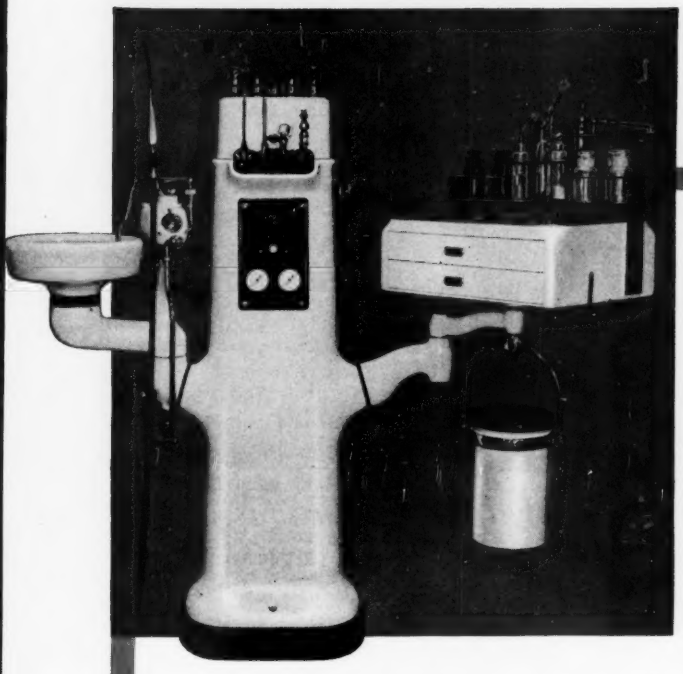

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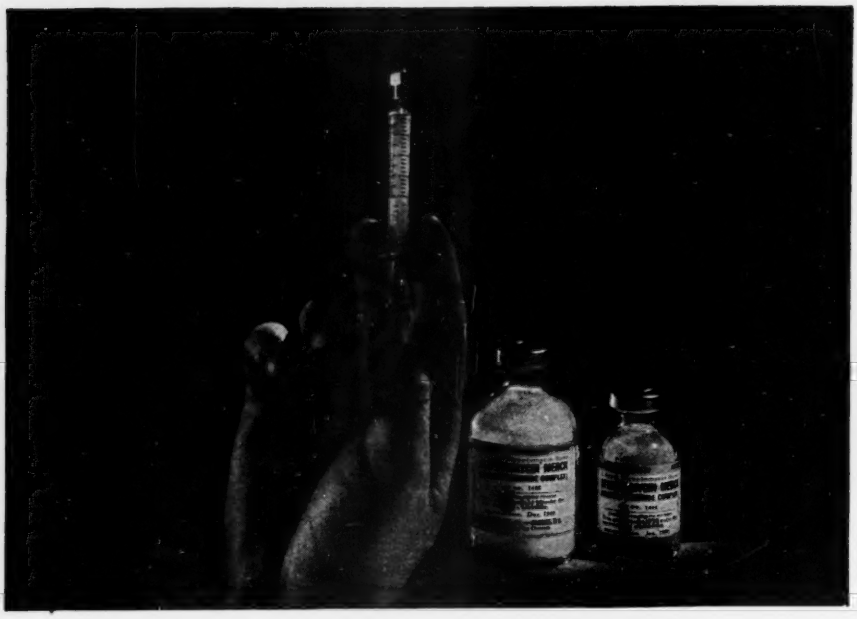

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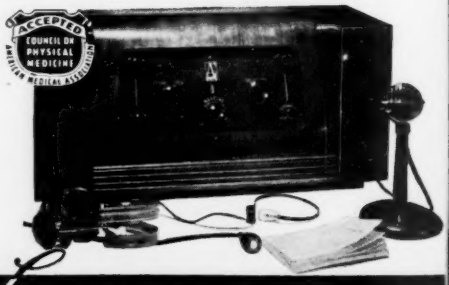

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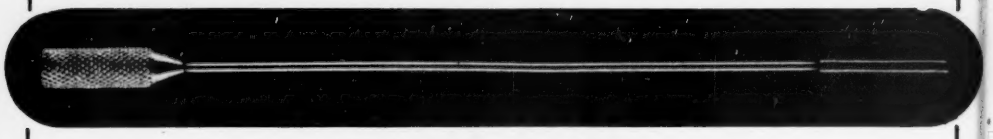

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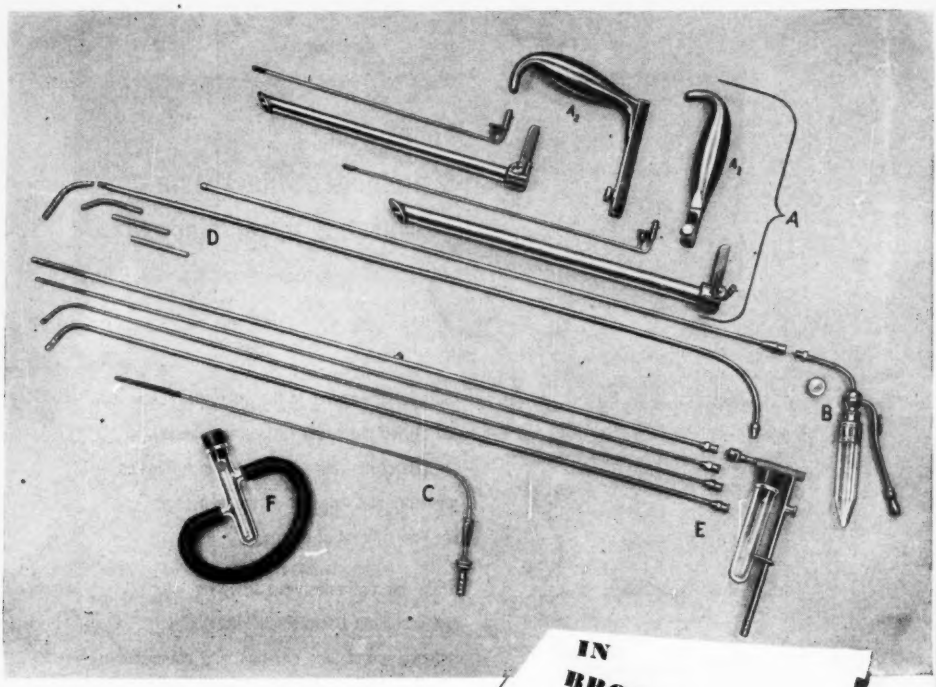

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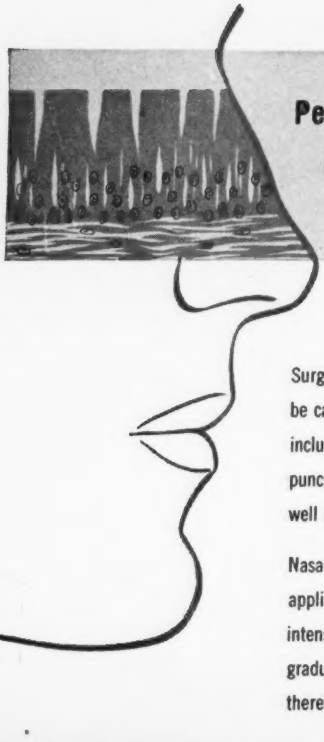

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MÉNIÈRE'S SYMPTOM COMPLEX

Its Relation to Chemistry; an Etiologic Study

GRANT SELFRIDGE, M.D.
SAN FRANCISCO

THE CAUSE of Ménière's disease is unknown; so say the wise men of the medical profession. It has been variously ascribed to: disturbances of endocrine glands; infection; syphilis; low and high blood pressure; disturbances of the metabolism of salt, potassium, magnesium, iodine and calcium; deficiencies of certain vitamins (those responsible for spasm of blood vessels, as deficiency of thiamine, nicotinic acid or choline compounds); allergy; creatine-creatinine metabolism, and the action of the nondecarboxylated fraction of histidine-histamine. No one, so far as I know, has attempted to relate the disease to disturbances of nutrition and thus to body chemistry. This is the purpose in this paper.

VITAMIN DEFICIENCIES RELATED TO MÉNIÈRE'S DISEASE

Since the appearance of the first edition of the work of Williams and Spies [1] on thiamine, in 1938, biologic and medical research have shown not only that degenerative changes occur in peripheral nerves but that, as Sure [2] aptly expressed it, "The Little Things in Life" have proved to be the big things in life and are helping to solve many of the complex problems with which man is beset today. In nothing has this been found more important than in Ménière's disease.

Covell,[3] studying the eighth nerve and the cochlea in rats, guinea pigs and chicks, showed that histologic changes of the nerve and its ganglion cells (both cochlear and vestibular) resulted from deficiencies of the vitamin B complex and that they sometimes occurred in lesser degrees in other deficiencies. Covell's studies were made at my suggestion when I was investigating the subject of nerve and conduction

1. Williams, R. R., and Spies, T. D.: Vitamine B, (Thiamin) and Its Use in Medicine, New York, The Macmillan Company, 1938.

2. Sure, B.: The Little Things in Life, New York, D. Appleton-Century Company, Inc., 1937.

3. Covell, W. P.: Pathological Changes in the Peripheral Auditory Mechanism Due to Avitaminosis, Laryngoscope **50**:632-647 (April) 1941; Vitamins and the Ear, ibid. **51**:683-691 (July) 1941.

deafness. Himwich [4] divided the vitamins into two groups: those demonstrated to be necessary for the prevention of degenerative changes of the central nervous system and those not required for the maintenance of nervous structures. In the first group he included thiamine (vitamin B_1), nicotinamide, riboflavin, pantothenic acid and pyridoxine (vitamin B_6); in the second, ascorbic acid and vitamins A, D and E. Mellanby,[5] however, reported that definite degenerative changes were produced by vitamin A–deficient diets not only in the central nervous system but also in the eighth nerve and that these changes in the nerve were not, in the early stages, due to pressure of new bone in the modiolus or elsewhere in the internal auditory meatus. Gladys Emerson,[6] of Evans' Laboratory, stated that the latter and his co-workers have found that changes occur in certain peripheral nerves in vitamin E–deficient guinea pigs. As another bit of evidence that vitamin deficiencies play an important role in the degenerative changes of the nervous system, Wolbach [7] stated, "No one vitamin is concerned with the maintenance of myelin." Morsch [8] presented histories of 4 patients with typical symptoms of Ménière's disease who also had symptoms of deficiencies of both vitamin A and ascorbic acid. He reported that an improvement was noted in the vertigo, tinnitus and deafness after intensive vitamin treatment.

The relationship of the vitamin B complex and Ménière's disease has been widely reported in the recent literature. Harris and Moore [9] were the first to report. They were impressed with the peculiar dietary habits of people with this disease, who were almost all addicted to diets in which vegetables or carbohydrates were preponderant and had an inadequate intake of protein. They treated 20 patients with large doses of thiamine hydrochloride. No result was observed. Then they used nicotinic acid. Again there was no result. Finally they combined both treatments, giving thiamine hydrochloride, 10 mg., night and morning, and nicotinic acid, 50 mg., five times a day. With this treatment there was entire relief of tinnitus in 10 cases and almost

4. Himwich, H. E.: The Role of Vitamins in Brain Metabolism, A Research Nerv. & Ment. Dis., Proc. (1943) **22**:33-41, 1943.

5. Mellanby, E. J.: The Experimental Production of Deafness in Young Animals by Diet, J. Physiol. **94**:380 (Dec. 14) 1938.

6. Emerson, G.: Personal communication to the author.

7. Wolbach, S. B.: Pathological Changes Resulting from Vitamin Deficiencies, J. A. M. A. **108**:7-13 (Jan. 3) 1937.

8. Morsch, P.: Vitamin Therapy of Ménière's Disease and Other Disorders Accompanied by Tinnitus and Vertigo, Acta oto-laryng. **27**:629-637, 1938.

9. Harris, H. E., and Moore, P. M., Jr.: The Use of Nicotinic Acid and Thiamin Chloride in the Treatment of Ménière's Syndrome, M. Clin. North America **24**:533-542 (March) 1940.

entire relief in the other 10. Seventeen patients were entirely relieved of vertigo, and the other 3 had sufficient relief to be able to return to their work. Harris,[10] in a letter dated Feb. 28, 1944, stated:

> . . . We are still using thiamine hydrochloride, 10 mg., three times a day, and nicotinic acid, 100 mg., three times a day, for an initial period of five months. I find the vast majority are relieved of their dizzy spells in from two to six weeks, and as the vertigo subsides, the tinnitus decreases in intensity. As our series of cases progresses, and we now have over 500, I believe that the nicotinic acid with the marked peripheral vasodilatation caused by it, is the chief factor of their relief.

Guggenheim,[11] referring briefly to Ménière's syndrome, cited the finding of Somyngi that in allergic states there is depletion of potassium salts in the cells and increase of these salts in the body fluid and that the depletion is corrected through administration of potassium and insulin. He also mentioned a case in which petechial hemorrhages and presence of blood in urine and stool suggested the possibility that permeability of the stria vascularis, increased through deficiency of ascorbic acid, was a cause of Ménière's disease. He stated further that the most important agent in the prevention of neural degeneration in Ménière's disease is the vitamin B complex, i. e., thiamine and nicotinic acid.

Atkinson[12] contributed a thorough and satisfactory review of the subject. He concluded that allergy and histamine sensitivity accounted for 20 per cent of his cases and that the remaining 80 per cent, cases in which the patient was nonsensitive, were related to lack of nicotinic acid. In 69 of 108 cases data were available for analysis. Relief of vertigo was reported in 32 cases. He considered the disease the result of a constriction of the vascular supply. In a letter dated Feb. 14, 1944, he wrote:

> I have just completed another paper on my results in 110 patients treated with nicotinic acid. In this series the tinnitus was removed entirely in 13 cases (12 per cent) and improved in 42 (40 per cent). Thus, in half the cases one can achieve an appreciable improvement in this symptom.

Cooper[13] emphasized the effects of choline compounds, which cause dilatation of the vessels supplying the viscera in mammals, and referred to Starr's report of relief of vertigo in 1 patient, suggesting that choline

10. Harris, H. E.: Personal communication to the author.

11. Guggenheim, L.: Treatment of Deafness, Laryngoscope **50**:773-783 (Aug.) 1940.

12. Atkinson, M.: Diagnosis and Treatment of Ménière's Disease, Arch. Otolaryng. **37**:40-53 (Jan.) 1943.

13. Cooper, M. J.: Clinical Observations on the Effect of Choline Compounds in Neurological Disorders with Special Reference to Ménière's Syndrome, Am. J. M. Sc. **195**:83-88 (Jan.) 1938.

compounds might be of value in the treatment of Ménière's disease. He reported that 6 patients who had taken methacholine chloride U. S. P. by mouth showed definite improvement or complete disappearance of tinnitus and vertigo, especially if the drugs were taken prophylactically or during the period of attack.

Adams [14] related deficiency of ascorbic acid to asthenia and Ménière's disease, in both of which there are apt to be autonomic imbalance and vasomotor disturbances. He observed several cases in which ascorbic acid was absent from the urine, probably because of lack of this vitamin in the diet, and in which the condition was improved or entirely relieved by an increased intake of fruit and food containing ascorbic acid. He referred to O'Dell's suggestion that lack of this vitamin was a frequent cause of Ménière's syndrome. In several cases Adams used some of the factors of the B complex in addition to ascorbic acid.

Because the lack of sufficient amounts of the vitamins, particularly of thiamine, nicotinic acid, riboflavin, pantothenic acid and pyridoxine, plays an important role in the aging process, one is justified in stating that Ménière's disease is a function of the aging process. Talbott and associates,[15] in a tabulation of 33 cases, showed that the patients were all 50 years old or older. In my studies, all the patients with eighth nerve deafness who were 40 years of age and over showed definite loss of high tones, severe in most of them. In all the cases the urine showed thiamine and nicotinic acid definitely low; in half the cases it showed porphyrin increased. When the eyes were checked for dark adaptation by Dr. Evelyn Blanchard with her "reginometer," the results were out of line in nearly all cases.[15a] Many of the patients were 60 years of age and over. It should not be forgotten that the aging process frequently begins in early childhood and not infrequently before birth. Stieglitz [16] made the comment that premature development of the changes of senescence in one or more organs might well be caused by particular dietary deficiencies of the parents and that the geriatric, anatomic and functional changes of the thyroid, pituitary and adrenal glands may be influenced by heredity, by the nutrition of the parents at the time of conception and by the nutrition of the mother before and after birth. The far reaching effect of nicotinic acid deficiency, for instance, has

14. Adams, J.: Ménière's Syndrome and Avitaminosis, J. Laryng. & Otol. **54**:256-258 (May) 1939.

15. Talbott, J. H.; Brown, M. R.; Coombs, F. S., and Consolazio, W. V.: Electrolyte Balance of Blood in Ménière's Disease, Proc. Soc. Exper. Biol. & Med. **38**:421-422 (April) 1938.

15a. The "reginometer" is thought to be an improvement over the biophotometer in use at that time.

16. Stieglitz, E. J.: Geriatric Medicine, Philadelphia, W. B. Saunders Company, 1943.

been depicted graphically by Frostig and Spies [17] and others. Sebrill, of the United States Public Health Service, in his histologic study of Jukes's rats, deficient in pantothenic acid, stated that both the adrenal cortex and the gonads showed beginning atrophy of cells. It is interesting that a few human subjects whom two genitourinary specialists of San Francisco treated with large doses of pantothenic acid (100 mg. daily intravenously) appeared to experience restorative effects in their flagging sex life.

The experimental dog, Benny, of Morgan and Simms [18] (fig. 1) shows an aging process induced by dietary measures that may have a definite analogy to that of human life. At the age of 6 weeks this dog was restricted to a diet deficient in pantothenic acid, nicotinic acid and some other factors, unknown. He showed considerable irregularity of gait, especially in the hindlegs, suggesting some disturbance of the

Fig. 1.—This dog shows the aging effect of a deficiency of pantothenic acid, nicotinic acid and other factors of the vitamin B complex. The experiment was reported by Morgan and Simms.[18]

vestibular apparatus. The aging process was evidenced by changes of posture, increasing grayness of hair, increasing ptosis of belly muscles and finally inability to stand erect. The dog died at the age of only 3 years; the average life span of a cocker spaniel varies from 8 to 12 years. Inasmuch as this dog's diet was normal except for the lack of pantothenic acid, nicotinic acid and some other factors, unknown, it seems obvious that the aging appearance and the pathologic changes are related to the missing factors. The autopsy report showed that the principal organ involved was the adrenal cortex.

17. Frostig, J. P., and Spies, T. D.: The Initial Nervous Syndrome of Pellagra and Associated Deficiency Diseases, Am. J. M. Sc. **199**:268-274 (Feb.) 1940.

18. Morgan, A. F., and Simms, H. D.: Graying of Fur and Other Disturbances in Several Species Due to Vitamin Deficiency, J. Nutrition **19**:233-250 (March) 1940.

This brings to mind the relation of pantothenic acid deficiency and fatty infiltrations and the possibility that the fatty substance may be cholesterol. Oakey [19] has already demonstrated that pantothenic acid is related to cholesterol in the production of dietary gallstones. It is known that choline is related to fatty livers and is a vasodilator substance, as is also nicotinic acid; hence these three substances may be definitely related to Ménière's disease, and perhaps to certain cardiovascular diseases. Certainly, these substances are present in inadequate amounts in some of the aging people whom I have observed in my studies of eighth nerve deafness.

ALLERGY AS A CAUSE OF MÉNIÈRE'S SYNDROME

Grove [20] has given the impression that most cases of Ménière's disease can be classified as cases of allergy. He stated that many patients present extra-aural symptoms, headaches, vasomotor rhinitis, chilly sensations, gastrointestinal symptoms, fatigability, insomnia and loss of memory and often have urticarias.

Dean [21] has shown a definite leaning toward allergy. He reported 2 cases. One patient was sensitive to several foods, which were removed from his diet. While this improved the vertigo, more complete relief was not obtained until the infected tonsils were removed. His second patient was sensitive to staphylococcus. Injections were helpful, but it was necessary to remove an infected adenoid and to correct a low basal metabolic rate with thyroid before a satisfactory result could be obtained.

AMINO ACIDS

Histamine is a noncarboxylated fraction of the amino acid histidine. Abandoned by its principal sponsors, Longcope, Haskin and Dwyer, of New York, it was resurrected, after nearly twenty-five years, by Horton [22] before the Clinical Congress of the American College of Surgeons in Chicago, in 1940, and has been written about favorably, especially by Grove [20] and Atkinson,[12] in relation to Ménière's disease.

Recently Horton and associates [23] stated that they had used histamine successfully in a large series of cases of multiple sclerosis. It is their

19. Oakey, R.: Gallstone Formation and Intake of B-Vitamins in Cholesterin Fed Guinea Pigs, Proc. Soc. Exper. Biol. & Med. **51**:349, 1942.

20. Grove, W. E.: Evaluation of Ménière Syndrome, Ann. Otol., Rhin. & Laryng. **50**:55-69 (March) 1941.

21. Dean, L. W., Jr.: Ménière's Syndrome, Internat. Clin. **3**:231-234 (Sept.) 1941.

22. Horton, B. T.: The Use of Histamin in Mèniére's Disease, Surg., Gynec. & Obst. **72**:417-420 (Feb.) 1941.

23. Horton, B. T., and others: Treatment of Multiple Sclerosis by Intravenous Administration of Histamine, J. A. M. A. **124**:800-801 (March 18) 1944.

opinion that the prompt improvement that follows histamine therapy probably results from the vasodilatation produced in the central nervous system. In the discussion of this paper, Wagener apparently questioned the findings, saying that the cases were followed for only fifteen months and that it would take at least five years to evaluate fully the effects of this treatment. Squier expressed the belief that with most allergic conditions histamine therapy would prove disappointing. He stated that he had seen 2 patients who had been given intravenous injections of histamine phosphate elsewhere and who had relapses during such therapy. These discussions show that medical opinions as to the value of histamine vary greatly but that the majority of physicians who have reported on the use of histamine do not consider that it tells the whole story.

Cordes [24] has shown that histamine can cause both arterial spasm and increased permeability of capillaries. He stated that histamine or histamine-like bodies circulating in the blood and their action on hypersensitive arterioles and capillaries can account for all the lesions usually attributed to cold, focal infection and allergy, that the pathologic changes are all due to spasm of smooth muscle and increased permeability of capillaries with resultant anoxia of capillaries and tissues. This constitutes further evidence that the reactions observed in the various allergies have fundamental causes other than protein sensitivity, which still remain to be identified.

INFLUENCE OF THE ELECTROLYTES

Mygind and Dederding [25] have advanced the theory that the symptoms of Ménière's disease, including tinnitus, are due to disturbance of the metabolism of water and that relief may be obtained by eliminating salt and water through perspiration and urination, stimulated by the use of pilocarpine or mersalyl. Tinnitus was not much affected. Cawthorne and Fawcett [26] reported that tinnitus, vertigo and, to a lesser extent, deafness were improved by diminishing the intake of fluids and that vertigo and deafness were made worse immediately when the intake of fluids was increased but were not greatly influenced by increasing the salt in the diet.

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24. Cordes, F. C.: The Use of Vasodilators in Acute Fundus Disease, Am. J. Ophth. **26**:916-927 (Sept.) 1943.

25. Mygind, S. H., and Dederding, D.: Clinical Experiments with Reference to the Influence of Water Balance on the Ear, Ann. Otol., Rhin. & Laryng. **47**: 360-369 (June) 1938.

26. Cawthorne, T., and Fawcett, J.: Fluid Balance in Ménière's Disease, Lancet **2**:1404-1409 (Dec. 17) 1938.

Talbott, Brown, Coombs and Consolagio,[15] and in a later report Talbott and Brown,[27] presented a careful laboratory study of the concentration of the acid-base constitution of the blood serum, including total fixed base, sodium, potassium, calcium, chloride, total carbon dioxide, phosphate, protein and nonprotein nitrogen. They expressed the belief that potassium salts are of far greater importance than sodium salts, which are implicated in the theory of Furstenberg, and that neither hydration nor alkalosis nor elevated serum sodium is a necessary accompaniment of Ménière's disease. Their chart indicates that the sodium-potassium ratio is definitely out of line, which should furnish a reason for their choice of therapy. They intimated that if the present laboratory methods of microbiologic and other studies of the blood for the members of the vitamin B complex (thiamine, riboflavin, nicotinic acid, nicotinamide, pantothenic acid, pyridoxine, biotin, inositol, para-aminobenzoic acid, adenylic acid, choline and folic acid), as well as for ascorbic acid and the tocopherols, were available much more would be known of the body chemistry.

Yoshiza treated tinnitus with magnesium sulfate. He made no mention of Ménière's disease, but Shick [29] stated that these salts have a diuretic effect and exert an influence on the entire central and peripheral nervous system, affecting the vasomotor mechanism, especially in the vestibular area. According to Sherman,[30] magnesium salts enhance the activity of the enzymes known as phosphatases and assist at certain stages in the metabolism of carbohydrates.

Little mention has been made of calcium being used in the treatment of Ménière's disease. Brunner [31] mentioned the use of calcium and iodine. In a letter dated Feb. 16, 1944 he said that he still used them in tinnitus and thought he obtained results; however, he seemed somewhat doubtful. Apparently his use of these substances has been empiric and not based on any laboratory studies. The constant shifting of the electrolytes is such that many determinations would be necessary over a period of weeks before the true picture would be known.

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27. Talbott, J. H., and Brown, M. D.: Ménière's Syndrome: Acid-Base Constituents of the Blood; Treatment with Potassium Chloride, J. A. M. A. **114**:125-130 (Jan. 13) 1940.

28. Footnote deleted by the author.

29. Schick, A.: Treatment of Ménière's Syndrome with Magnesium Salt, Ann. Otol., Rhin. & Laryng. **52**:45-51 (March) 1943.

30. (*a*) Sherman, H. C.: Chemistry of Food and Nutrition, New York, The Macmillan Company, 1941. (*b*) McCance, R. A., and Widdowson, E. M.: The Chemical Composition of Foods, Medical Research Council, Special Report Series, no. 235, London, His Majesty's Stationery Office, 1940.

31. Brunner, H.: Ménière's Syndrome, Laryngoscope **49**:877-911 (Oct.) 1939.

THE ENDOCRINE GLANDS

Drury [32] observed in 568 cases of Ménière's syndrome that the pituitary gland was disturbed in 289, the thyroid gland in 148, the gonads in 119 and the adrenal cortex in 12. In the detailed study of 4 cases, classified as cases of Ménière's disease due to hypothyroidism, he gives an excellent exposition of the accompanying symptoms.

Werner [33] simply mentioned that tinnitus and vertigo may occur without causative lesions (no cardiovascular lesion). This is not an uncommon situation at the approach of, during and after the menopause.

Lisser,[34] in a letter dated March 28, 1944, stated:

> I have had a good friend, a man of 60 years, under observation in the last two years, who had had three characteristic attacks of Ménière's disease prior to getting established on a proper maintenance dose of thyroid. He had a low basal metabolic rate, although he had no obvious symptoms or signs of hypothyroidism. He required 5 grains [0.32 Gm.] daily to maintain his rate at a normal level, and now for fully one and one-half years he has had no further attacks.

Selfridge [35] studied basal metabolic rates, hemoglobin content, intake of vitamin B complex, excretion of porphyrin (in urine), type of tinnitus and nature of catamenia in a series of patients with Ménière's syndrome. The basal metabolic rate was out of line in most of them. Most of the patients were markedly improved by the use of several vitamins, estrogenic substances and thyroid when these were indicated. A recent review of the subject indicates that pseudo Ménière's disease is not uncommon in younger persons, that it is often present in women during the menopause and that in the treatment of the latter the use of multiple tocopherols, as suggested by Spies, particularly in cases of nonorganic tinnitus, is not to be forgotten.

Little has been said on the subject of amino acids and their importance in the general metabolic picture, but Holt,[36] in a paper presented at the Cleveland meeting of the American Chemical Society, in 1944, emphasized the importance of tryptophane, arginine, valine and methionine in warding off certain signs of senility, i. e., baldness, decay of teeth, anemia, cataract, permanent bloodshot appearance of the eyes, degeneration of the gonads in the male and reproductive failure in the female.

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32. Drury, D. R.: Syndrome Complex, New England J. Med. **220**:170-173 (Jan. 24) 1939.

33. Werner, A. A.: Ovarian Hypofunction and Afunction, in Endocrinology: Clinical Application and Treatment, Philadelphia, Lea & Febiger, 1937, pp. 239-240.

34. Lisser, H.: Personal communication to the author.

35. Selfridge, G.: Chronic Progressive Deafness with Special Reference to Estrogenic Substances, Ann. Otol., Rhin. & Laryng. **49**:52-55 (Aug.) 1940.

36. Holt, L. E., Jr.: Elixir of Youth in Protein, Science News-Letter, April 15, 1944, pp. 252-253.

It has already been shown that the active chemical agents of the endocrine glands are proteins—amino acids—but the chemical formulas of the six active fractions of the anterior lobe of the pituitary gland are unknown. Much studying has been done but it may continue for generations before the formulas are worked out. The formulas of most of the amino acids and of the vitamins have been published, and the chemical setups of all foods and beverages have been published by Sherman [30a] and McCance and Widdowson.[30b]

It is agreed that the chemical actions, reactions and interactions occurring in the human body are controlled by the endocrine glands and that the pituitary gland, especially the anterior lobe with its six known fractions, controls all the other glands. The thyroid gland ranks first in the control of the metabolic processes, including that concerned with water, and the adrenal cortex appears to have a controlling action on most of the electrolytes and also on several of the vitamins. The gonads should not be ruled out, especially as the menopause approaches and emotional factors appear. Even at other ages of life tinnitus and sensations of dizziness are influenced by estrogens and also by androgens.

Carbohydrate when converted to dextrose is the most important chemical substance in cerebral metabolism. The first studies of this conversion, by Peters,[37] of Oxford, England, implicated thiamine as the principal factor in the process by which dextrose is converted through the intermediary of pyruvic acid to lactic acid, but it is now considered that thiamine, riboflavin, nicotinic acid and ascorbic acid are the principal factors in carbohydrate metabolism, and this combination, especially with choline added, is believed to influence fat metabolism also. In addition to this action on carbohydrates and fats, investigators are beginning to believe that these substances have an important influence on the vasomotor system. Long,[38] in his discussion of carbohydrate metabolism and its relation to the endocrine gland system, gave the definite impression that while the anterior lobe of the pituitary gland is the great controller, all the glands are involved in the process of carbohydrate metabolism. Elvehjem [39] pointed out that thiamine, as such, inhibits the action of cholinesterase, especially when the dosage of thiamine is at high levels. Thus, some of the symptoms associated with thiamine deficiency may be correlated with a decreased acetylcholine content of certain tissues of the body as well as with an increased pyruvic acid content.

37. Peters, R. A.: The Biochemical Lesion in Vitamin B Deficiency, Lancet 1:1161-1164 (May 23) 1936.

38. Long, C. N. H., in Duncan, G. G.: Diseases of Metabolism, Philadelphia, W. B. Saunders Company, 1942, pp. 19-71.

39. Elvehjem, C.: Relationship of Enzymes to Deficiency: Nutritional Deficiencies, Baltimore, Williams & Wilkins Company, 1943.

WATER METABOLISM

This subject apparently is confusing, since Dederding and Furstenberg, and their groups, have held that Ménière's disease is linked with water binding and sodium chloride, while Talbott and his co-workers have concluded that it is related to potassium salts. Goldzieher [40] pointed out that the actual requirements of the body and the amount of water retained are almost independent of the intake of water and yet are subject to both environmental and endocrine influences, and that the presence of such ordinary cell constituents as sodium salts, certain chlorides and carbohydrates is known to increase the avidity of the tissues for water. The posterior lobe of the pituitary gland plays a definite role in the control of water metabolism in cases of diabetes insipidus, and the thyroid gland has a definite part in the control of water and salt metabolism, especially in cases of myxedema. Likewise, the adrenal cortex, often called the gland vital for life, has an important role to fulfil not only as a controller of water balance but also as the probable controller of several of the electrolytes—sodium, potassium and perhaps others. In addition, it has some influence on the members of the vitamin B complex and on ascorbic acid. Deficiency of pantothenic acid definitely influences the adrenal cortex, and Sebrell noted atrophy of the cortical cells as well as of the gonads. Gower [41] linked riboflavin, pantothenic acid and possibly some other vitamins of the B complex to water metabolism. Dr. Marjorie M. Nelson, of the department of biological research of the University of California, told me that animals deficient in pantothenic or in nicotinic acid showed definite evidences of dehydration, and Lepkovsky, of the department of poultry research of the University of California, told me that animals deficient in pyridoxine were avid for water. These various findings are but suggestions that in Dederding's and especially in Furstenberg's cases the symptoms might have been controlled by other means than ammonium chloride and salt-free diets.

Tobey [42] closed an excellent review of the medical treatment of Ménière's disease with these words:

> . . . It is apparent that studies in water and mineral metabolism have yielded definite results, and still offer a fertile field for investigation. Development in our knowledge of vitamins shows promise of increasing influence in the treatment of Ménière's disease.

40. Goldzieher, M.: Biological Aspect of Constitution, A. Research Nerv. & Ment. Dis., Proc. (1933) **14**:122-137, 1934.

41. Gower, S.: Water Metabolism, Proc. Soc. Exper. Biol. & Med. **49**: 691-692 (April) 1942.

42. Tobey, H. G.: Medical Treatment of Ménière's Disease, Surg., Gynec. & Obst. **72**:425-430 (Feb.) 1941.

PSYCHOSOMATIC AND WEATHER PROBLEMS

Psychosomatic conditions and physical stresses imposed by changes of weather have a bearing on the subject of tinnitus, whether this occurs singly or as a symptom of Ménière's disease, and are mentioned by Fowler in his recent study of tinnitus, but with not enough emphasis, in my opinion, on the psychosomatic picture. Apparently, little attention has been paid to emotional factors in pseudo Ménière's and real Ménière's disease. Weiss and English [43] related tinnitus to anxiety states, sexual tension and disease of blood vessels, and stated that the tinnitus is vastly increased if there is any degenerative involvement of the eighth nerve, and that suggestive treatment is in order.

Kerr,[44] since World War I, has written at some length on anxiety states. He mentioned that patients suffering from anxieties presented symptoms and signs of tetany associated with hyperventilation. In a recent conversation he mentioned having seen several more cases of Ménière's disease since publishing his first article, and emphasized the need of a study of the acid-base balance in all cases. He expressed the belief that a large proportion of people consulting physicians since World War I and during the present world crisis are victims of anxiety states with symptoms that simulate those of serious organic diseases. Hence the study of psychosomatic medicine and geriatrics should be followed intensively by those really interested in improving the health and well-being of patients consulting otolaryngologists.

Another factor, and a potent one, influencing these psychosomatic conditions has been set forth in a convincing maner by Peterson and Mills. In 1934 Peterson [45] discussed at some length the season of the year and the effects of cold, and mentioned that in Ménière's original case the first episode occurred on Dec. 28, 1860, and another on February 6, during the winter months. He considered further the relation of abnormal water balance and defective vasomotor function, hearing as affected by heat and cold and the close integration of Ménière's syndrome, migraine, epilepsy and psychoses. He seemed to think Ménière's syndrome is frequently initiated with meteorologically induced vascular spasm and that the acute attacks have a tendency to occur in the later winter and early spring months, when polar infalls (cyclonic types of weather) are apt to occur. The type of arterial

43. Weiss, E., and English, O.: Psychosomatic Medicine, Philadelphia, W. B. Saunders Company, 1943, p. 475.

44. Kerr, W. J.: Some Physical Phenomena Associated with the Anxiety States and Their Relation to Hyperventilation, Ann. Int. Med. **11**:961-992 (Dec.) 1937; Treatment of the Anxiety States, J. A. M. A. **113**:637-641 (Aug. 19) 1939.

45. Peterson, W. F.: The Patient and the Weather, Ann Arbor, Mich., Edwards Brothers, 1934, vol. 2, p. 489.

spasm referred to by Selfridge in two recent articles [46] is similar to the type due to polar infalls.

Mills [47] told a fascinating story of the life of man as affected by climate and meteorologic factors and showed that the Chinese, because of the lack of cyclonic weather and because of a diet consisting largely of soybeans, do not have arteriosclerosis and coronary disease. He pointed out the various factors involving, in particular, the peoples of the United States. He stressed the observation that many symptoms in people, and bad moods and many actions of both animals and human beings are definitely related to "falling barometers." He stated that the exact mechanism by which such weather changes affect human beings in so many ways is not yet known; then he added:

> . . . Peterson believes it is all due to a shifting chemical balance in the blood and body tissues. . . . Other preliminary findings indicate that our tissues take up more water at such times, and a resulting slight swelling of the brain may upset us emotionally.

SUMMARY

I have repeatedly pointed out that deafness (and this includes Ménière's disease) is not caused by any one thing but is related to all the factors involved in growth, i. e., endocrine products, electrolytes, amino acids and vitamins, including vitamin A. Guggenheim,[11] while he advocated that vitamins D and A be used along with ascorbic acid and the vitamins of the B complex in the treatment of other forms of deafness, did not advise that they be used in the treatment of eighth nerve involvement. Gladys Emerson [6] stated that Evans and his co-workers have shown that guinea pigs born of parents slightly deficient in tocopherol (vitamin E) and themselves quite deficient at birth apparently made a complete recovery, provided this factor was administered within fifteen days. In my experience, patients with eighth nerve deafness who had only a slight loss of high tones recovered the loss in a few weeks with the use of thiamine and nicotinic acid, whereas patients who had an abrupt loss in the audiometric curve did not show any recovery. Babbitt emphasized the well known fact that when the nerve is badly damaged the pathologic process cannot possibly be reversed by any use of endocrine substances, vitamins, electrolytes or amino acids. He mentioned the brilliant studies of Crowe and associates on the loss of perception of the higher tones in children due to tubal stenosis and stressed the importance of preventive measures (radium treatment of adenoid remnants); failure to treat such conditions in

46. Selfridge, G.: Arterial Spasm and Fat Metabolism: Their Relation to Certain Diseases and to Certain Members of the Vitamin B Complex, California & West. Med. **62**:163 (April) 1945; Ann. Otol., Rhin. & Laryng. **54**:384-389 (June) 1945.

47. Mills, C.: Climate Makes the Man, New York, Harper & Brothers, 1942.

48. Footnote deleted by author.

children may mean high tone deafness in the aging period of life. Babbitt made the statement that in the management of aging ears the three most troublesome conditions are deafness, vertigo and tinnitus, inevitably present in the complex Ménière's syndrome. To all this I subscribe, bearing in mind, however, that all aged patients are not the victims of pseudo or real Ménière's disease and that a small percentage of those who suffer from these diseases can be relieved when the proper chemical therapy is worked out. To determine deficiencies of the diet one must have a complete list of the foods eaten each day in a period of one week, detailing the quality and the quantity of each food. In addition, a thorough physical examination should be made, and the usual laboratory studies, including determinations of the blood levels of all vitamins, electrolytes and some amino acids. A large part, or even the whole, of the etiologic problem, including the role of the adenoids, is definitely related to dietary deficiencies, which can explain the continued infection of this tissue. Blockage caused by tubotympanic tissue is definitely related in many cases to riboflavin deficiency. Covell [8]

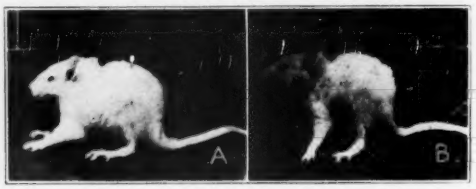


Fig. 2.—These rats are about to have a definite attack of vertigo, the cause of which is a deficiency of thiamine.

has shown that this blockage is present just at the point where the eustachian tube enters the middle ear. I have noticed that in patients with this type of ear who also complained of stuffy nose and postnasal drip, mucoid in character, with no pus present, improvement followed administration of riboflavin (30 mg. daily) or a vitamin B complex preparation with vitamin A and ascorbic acid added.

Crowe, discussing an article by Altman and Fowler Jr.,[49] mentioned having observed 1,000 cases of Ménière's disease, and wrote, in an article in *Medicine,* that patients with this disease are extraordinarily free from general systemic disorders, such as cardiorenal disease, arteriosclerosis, focal infections and allergies. He did not obtain satisfactory results with histamine and nicotinic acid and concluded that surgical division of the labyrinthine branch of the eighth nerve was the only procedure that offered relief from the terrible vertigo. However, Talbott,[15] of the Massachusetts General Hospital, has not advocated

49. Altman, F., and Fowler, E. P., Jr.: Histological Findings in Ménière's Symptom Complex, in Bothman, L., and others: The 1943 Yearbook of Eye, Ear, Nose, and Throat, Chicago, The Year Book Publishers, Inc., 1943, p. 403.

surgical procedures since his adoption of the use of potassium chloride, and Davis, of the Cleveland Clinic, said in a letter of recent date that the neurologic surgeons of that clinic have not divided the nerve since the decision to try diets and administer thiamine hydrochloride and nicotinic acid in large doses over periods of months. Five hundred cases have been studied since their first 20 cases in which such treatment was given were reported in 1940.

In the laboratory studies of blood chemical and dietary deficiencies, pantothenic acid was determined by the method of Strong, Feeney and Earle,[50] riboflavin by the method of Snell and Strong,[51] and nicotinic acid by the method of Krehl, Strong and Elvehjem.[52] Other suggested laboratory procedures are the determination of the basal metabolic rate, the complete blood sedimentation rate, vitamin A and carotene, ascorbic acid, cholesterol, sulfobromophthalein sodium, chlorides, sodium, potassium, calcium, phosphorus, blood sugar, urea nitrogen and, when possible, choline-tocopherols, trace minerals, special amino acids and acid-base balance.

COMMENT

The principal treatments advocated for Ménière's disease are:

1. Surgical section of the labyrinthine branch of the eighth nerve.
2. Those related to the metabolism of salt and water.
3. Those related to the metabolism of potassium.
4. Those related to the use of certain vitamins, especially thiamine and nicotinic acid, nicotinic acid alone, and a member of the group of choline compounds (choline is now known as a fraction of the B complex).
5. Those related to the use of histamine.

A review of the recent literature gives the impression that the most favorable results have followed the use of several of the vitamins. Apparently, since the use of electrolytes, vitamins or endocrine substances began, surgical intervention has lost its popularity. Since the vitamins and the endocrine substances are so closely allied, as shown by their chemical formulas, it hardly seems preposterous to make the claim that Ménière's disease is a chemical problem still requiring further study if and when more is known of the rare minerals and the recent, almost unknown factors added to the list of vitamins, and that it is related to nutritional and environmental factors.

1000 California Street.

50. Strong, F. M.; Feeney, R. E., and Earle, A.: Pantothenic Acid, Indust. & Engin. Chem. (Anal. Ed.) **13**:561, 1941.

51. Snell, E. E., and Strong, F. M.: Riboflavin, Indust. & Engin. Chem. (Anal. Ed.) **11**:346, 1939.

52. Snell, E. E., and Wright, L. D.: Microbiological Method for Determination of Nicotinic Acid, J. Biol. Chem. **139**:675-686 (June) 1941.

FOREIGN BODIES OF THE EXTERNAL AUDITORY CANAL CAUSING OTITIS MEDIA

KINSEY M. SIMONTON, M.D.
ROCHESTER, MINN.

FOREIGN bodies impacted in the external auditory canal or the middle ear may be of serious importance. Any object small enough to enter the external auditory canal is a potential foreign body in this location. Foreign bodies enter the external auditory canal by act of the person concerned, by carelessness and by accident. Small objects such as seeds, beads, rubber erasers from pencils, steel springs, balls of paper or stones may be placed in the ear by children at play. Adult persons in misguided therapeutic efforts scratch the external auditory canal with match sticks, toothpicks and hairpins. Cotton pledgets and gauze wicks placed in the external auditory canal by patient or physician may be forgotten and left in the canal, as may rubber ear plugs used by swimmers. One patient has been seen at the Mayo Clinic in whom a cast of plaster of paris became lodged against the tympanic membrane while an impression was being made for the ear piece of a hearing aid. Flying insects are the most frequent of the foreign bodies which enter the ear by accident. Workmen are subject to having flying bits of plaster, drops of paint, wood chips or small stones enter the ear. Gasoline or oil may enter the ears of automobile mechanics. Bits of straw and the seeds of foxtail grass are found in the ears of farmers. Cerumen that has become dry and hard acts as a foreign body.

The tympanic membrane is damaged by relatively few of the foreign bodies which enter the external auditory canal. Injury of the membrane results from (1) trauma inflicted direct, by the entering foreign body, (2) caustic or irritating action of the foreign matter, (3) prolonged contact of the foreign body with the drum and (4) trauma incurred during attempts at removal of the foreign body.

DIRECT TRAUMA

Perforation of the tympanic membrane occurs occasionally when the external auditory canal is scratched with a match stick or a similar object which is inserted too far into the canal. The extreme sensitivity of the external auditory canal is nature's best protection against this

From the Section on Otolaryngology and Rhinology, Mayo Clinic.
Presented at the meeting of the Minnesota Academy of Ophthalmology and Otolaryngology, Rochester, Minn., May 16, 1947.

accident. The sharp pain incident to perforation of the tympanic membrane causes immediate removal of the foreign body. Inflammation resulting from this accident usually is slight and is confined principally to the drum. Healing by first intention generally occurs without significant sequelae. The curvature of the external auditory canal protects the tympanic membrane from being injured by flying foreign bodies unless the foreign body enters the canal with extreme force.

CAUSTIC ACTION

Destruction of the tympanic membrane due to the caustic action of foreign matter in the external auditory canal causes severe damage of the structures of the tympanic cavity. Two cases will illustrate this point.

A man complained of bilateral loss of hearing. He stated that he had placed a solution of phenol in each external auditory canal in order to escape duty with the German Army in World War I. Examination revealed complete destruction of the tympanic membrane and other structures of the middle ear. The tympanic cavities were lined with dense, glistening scar tissue. Severe deafness of the conduction type was noted in each ear.

A man stated that sludge from the bottom of an automobile gasoline tank had entered his left ear six years previously. He had suffered immediate severe pain, followed by continuous drainage of foul pus from the ear and occasional headache and vertigo. Examination revealed severe deafness of the conduction type. A large polyp, which arose from a perforation in the posterosuperior portion of the tympanic membrane, filled the external auditory canal. Roentgenograms were interpreted as showing the cavity of a cholesteatoma. Radical mastoidectomy was performed. A large cholesteatoma cavity was found, which exposed the dura in the temporal fossa. The middle ear was filled with granulations; the ossicles were necrotic.

Gasoline which enters the external auditory canal causes severe pain. If the patient heeds this warning and has the gasoline removed within a few minutes, damage is limited to acute inflammation of the canal and the drum. Prolonged exposure to the irritant may cause necrosis of the drum.

PROLONGED CONTACT

Most foreign bodies cause irritation and pain. This is fortunate in that the patient seeks the assistance of a physician, so that the foreign body is removed before the inflammatory reaction becomes advanced. Living foreign bodies (insects) cause marked irritation by their movements, and are removed early. Inanimate foreign bodies cause irritation by pressure. However, foreign bodies sometimes are found which obviously have been in the external auditory canal for a long period, the patient having been unaware of them. Cotton pledgets and small rolls of paper frequently cause no irritation. Infection of secretions which cannot be discharged from the external auditory canal because of an obstructing foreign body results in otitis externa and myringitis,

and may cause perforation of the tympanic membrane by ulceration. Tightly lodged foreign bodies that prevent escape of secretions and desquamated epithelium may lead to the formation of cholesteatoma in the external auditory canal. This is illustrated by solid masses of cerumen covered by concentric layers of desquamated epithelium which cause necrosis of the tympanic membrane and tympanic ring to form the so-called natural radical mastoidectomy cavity. The following cases illustrate damage done to the tympanic cavity by various retained foreign bodies.

A soldier was admitted to a military hospital complaining of unilateral loss of hearing. Examination revealed a tightly impacted mass of cerumen which resisted removal by irrigation and curet. With the patient under the influence of general anesthesia, the mass was removed. It was surrounded by concentric layers of cholesteatoma which had destroyed the tympanic membrane and the ossicles, and had eroded widely into the periantral region of the mastoid process. The facial nerve was exposed in the cavity, and was injured during removal of the mass.

A boy 7 years old complained of pain in the left ear of twenty-four hours' duration. A watermelon seed, which apparently had been in the external auditory canal for a prolonged period, was removed. The canal was inflamed, but the tympanic membrane was normal at the time the seed was removed. On the next day a bleb was noted on the tympanic membrane and was incised. Pain persisted and was accompanied by gradual development of myringitis and otitis media. Recovery occurred after myringotomy was done.

A boy 8 years old complained of fever and of pain in the right ear of twenty-four hours' duration. A kernel of corn was removed from the right external auditory canal. A perforation was present in the tympanic membrane, which was inflamed. Drainage from the middle ear persisted for two weeks, at the end of which the perforation healed.

A man 61 years old complained of itching and swelling of the ears of fifteen years' duration. He said that the right ear drum was absent. He had undergone much treatment without relief, and often he had scratched the external auditory canals with cotton until bleeding occurred. Examination revealed marked thickening of the skin of the auricles, conchae and canals of both ears. The external auditory canals were narrow. Foul-smelling pus was present in the right external auditory canal; epithelial debris was present in the left. At the initial examination a broken piece of toothpick was removed from the right external auditory canal. Treatment by dressings kept wet with solutions of penicillin, sodium aspergillate and aluminum acetate did not produce improvement in the right ear. Radical mastoidectomy was performed on the right side. Chronic inflammation of the mastoid cells was found. A piece of string, 1½ inches (about 4 cm.) long, was removed from the tympanic cavity. The patient had not been aware of the presence of either foreign body.

After the operation a cotton wick was placed in the patient's left external auditory canal. The patient returned later in the day complaining of sudden loss of hearing. The cotton wick had been pressed tightly against the drum, medial to the isthmus.

TRAUMA INCIDENT TO REMOVAL

Foreign bodies which become lodged in the bony portion of the external auditory canal medial to the isthmus lie near or against the tympanic membrane. Removal should be achieved by irrigation if

possible, or manipulation should be carried out with the utmost care. If the foreign body is tightly lodged, the difficulty of removal is increased by swelling of the wall of the canal due to inflammation or to trauma from attempted removal. General anesthesia should be employed for the removal of tightly lodged foreign bodies. In some cases it is best to approach the foreign body through the mastoid process to avoid damaging the tympanic membrane.

A boy 7 years old was brought to the clinic because of a bead in the left ear which had been present twenty-four hours. A similar bead had been removed from the right ear. Attempts to remove the bead through the external auditory canal and through a postauricular incision had been unsuccessful. A probe had been broken off in these attempts, and the tip of the probe remained in the left ear. Examination revealed a recent postauricular incision on the left side. The external auditory canal was large, with little inflammatory reaction. Roentgenograms revealed a bead in the left external auditory canal, medial to the isthmus. A small bit of metal lay below the bead.

With the patient under general anesthesia, the bead was manipulated, engaged with forceps and removed through the external auditory canal. A small bit of metal, the tip of the probe, was found embedded in granulations in the region of the eustachian tube. The malleus was clearly visible after removal of the foreign body, indicating destruction of the tympanic membrane. Because of loss of epithelium from the wall of the external auditory canal at the isthmus, a rubber tube was left in the canal to prevent atresia. The patient was able to hear a low conversational voice in the left ear after removal of the foreign body.

SUMMARY AND CONCLUSIONS

A foreign body lodged in the external auditory canal may cause damage to the tympanic membrane and the tympanic cavity. The patient may not be aware of the presence of the foreign body. Early removal of foreign bodies is advised, especially when they are substances which cause necrosis of tissues. Great care is necessary to avoid injuring the tympanic membrane during manipulation of the foreign body. The use of general anesthesia is advisable during removal of lodged foreign bodies.

LEMPERT ENDAURAL SUBCORTICAL MASTOIDOTYMPANECTOMY FOR THE CURE OF CHRONIC PERSISTENT SUPPURATIVE OTITIS MEDIA

JULIUS LEMPERT, M.D.
NEW YORK

THE CHIEF complaint of almost every patient suffering from otitis media purulenta chronica without intracranial complications, for whom mastoidotympanectomy is indicated and advocated by his otologist, is, as a rule, the annoying discomfort of the persistence of his long-standing middle ear discharge, the arrest of which has resisted all available medicinal therapy.

The average otologist, when suggesting the advisability of the patient's undergoing mastoidotympanectomy, is, however, reluctant to comfort the patient with the reasonable assurance that if he accepts the advice offered, a permanently dry middle ear will be his reward. The same otologist will nevertheless often volunteer unhesitatingly the unsolicited information that by submitting to this operation the possibility of intracranial extension of the presently existing infection will be avoided.

Both the unwillingness of the otologist to reasonably assure the patient of a permanently dry middle ear and his volunteering the information that intracranial extension of the infection will thus be prevented are, as a rule, statements of facts which he has observed in his own experience of the mastoidotympanectomy without attempting to analyze and determine the *raisons d'être* which make such scientifically inconsistent facts possible.

The prevention of intracranial extension of the infection is naturally governed by the same surgical factors in the performance of mastoidotympanectomy which govern the arrest of the suppurative discharge, namely, the complete exenteration of the foci of infection. It is therefore inconsistent for an otologist to give hope for the prevention of extension of the infection in the face of his lack of confidence regarding his ability to arrest the discharge.

The right to suggest that the mastoidotympanectomy which he will perform will, as a rule, prevent intracranial extension of the infection could therefore be his only if he could also assure the patient of obtaining a permanently dry middle ear as a result thereof.

A careful analysis of the natural clinical course of otitis media purulenta chronica would illustrate to him that the failure of intracranial extension to occur in the vast majority of instances despite the fact that

the discharge was not arrested by the operation need not necessarily be credited to the mastoidotympanectomy which he performed, since the incidence of such extension of otitis media purulenta chronica is naturally quite small even without surgical intervention.

A critical self analysis of the way he performs a mastoidotympanectomy would however definitely clarify for him why he cannot reasonably promise a dry ear. He would soon be convinced that such a promise cannot, as a rule, be fulfilled unless all the foci responsible for the infection are completely exenterated.

In other words, if he were to analyze the statements which he made, he would find that the conservatism of his refusal to promise the patient a dry ear is based on his uncertainty of succeeding in the removal of the foci of infection with mastoidotympanectomy as he performs it, while his extravagant promise to prevent the infection from spreading is based on the normally inherent odds against intracranial extension of the infection, which favor this promise despite the fact that he may perform the mastoidotympanectomy incompletely.

In order for an otologist to place himself in the position of being able to give his patient the naturally expected reasonable assurance that with the mastoidotympanectomy which he intends to perform the middle ear purulency will cease to exist and to volunteer the information that the intracranial extension of the middle ear infection will also be prevented—prevention which can follow only if the middle ear purulency has been permanently arrested—he must (1) be confident that in performing the mastoidotympanectomy he will always explore all the pathologic processes responsible for the existing discharge and completely remove them and (2) choose a technic for performing the mastoidotympanectomy which is most conducive and most encouraging to such exploration and exenteration of the pathologic processes involved.

Any one or more of the following pathologic involvements may be encountered during the performance of the mastoidotympanectomy:

1. Chronic suppuration of cell structure of the mastoid process.
2. Cholesteatoma within the antrum or extending from the antrum to any part of the mastoid process.
3. Infected polypi and granulations within the antrum of the mastoid process.
4. Necrosis of the bony plate of the dura in the region of the middle or the posterior fossa.
5. Necrosis of the bony plate of the lateral sinus.
6. Necrosis of retrofacial cells of the mastoid with chronic abscess in the retrofacial cell region.
7. Chronic epidural abscess in the region of the middle fossa or of the posterior fossa.
8. Chronic perisinus abscess in either the anterior or the posterior perisinus cell region.
9. Chronic abscess in the region of the emissary vein.
10. Chronic necrosis of the zygomatic cells.
11. Necrosis of the perilabyrinthine cell structure.

12. Necrosis of the mastoid portion of the fallopian canal with exposure of the facial nerve.
13. Cholesteatomatous erosion with fistulization of the bony capsule of the external semicircular canal.
14. Cholesteatomatous erosion with fistulization of the bony capsule of the superior semicircular canal.
15. Cholesteatomatous erosion with fistulization of the bony capsule of the posterior semicircular canal.
16. Cholesteatoma in the epitympanum.
17. Polypi and granulations in the epitympanum.
18. Necrosis of remnants of the ossicular chain.
19. Cholesteatoma in the tympanum.
20. Polypi and granulations in the tympanum.
21. Necrosis of epitympanic and tympanic portions of the fallopian canal, with the facial nerve exposed and covered by granulation tissue.
22. Thickened, infected mucoperiosteum lining the promontory of the cochlea and the rest of the tympanic cavity.
23. Fistula in the cochlear promontory.
24. Cholesteatoma, polypi and granulations in the hypotympanum.
25. Necrosis of the protective bony dome of the bulb of the jugular vein.
26. Necrosis of perieustachian cells.
27. Infected tensor tympani muscle.
28. Necrosis of the tympanic pericarotid cells.
29. Necrosis of the bony wall of the tympanic carotid canal.
30. Chronic suppuration of the apical retrocarotid cells.
31. Cholesteatoma and granulations surrounding and enveloping the stapedial crura in the oval window niche.
32. Granulations and polypi filling the round window niche.
33. Granulations and polypi in the region of the tympanic orifice of the eustachian tube.

If a permanently dry middle ear is to be obtained as a result of a mastoidotympanectomy, then any one or more of the aforementioned pathologic involvements, when present, must be explored and removed. The traditionally accepted and most commonly employed technic of mastoidotympanectomy, known as the Schwartze postauricular radical mastoidectomy, is not conducive to, and does not encourage, the average otologist to either successfully explore, or completely eradicate surgically when explored, the varied and multiple pathologic processes which may be encountered. Only after a large experience of this technic can the especially skilled otologist cope successfully with the commonly encountered small sclerotic mastoid process and perform a complete mastoidotympanectomy, and then not always without accident.

Judging by the incomplete manner in which the Schwartze postauricular radical mastoidectomy is being performed by the average otologist, one must conclude that the adjective "radical" appears to be an exaggeration. Considering the inadequacy with which this procedure is being performed in the majority of instances, one does not

wonder that the patient's hope of obtaining a permanently dry middle ear as a result of submitting to this surgical procedure is most often not fulfilled.

The average otologist when performing the Schwartze radical mastoidectomy does not in the majority of instances remove completely the pathologic process responsible for the middle ear discharge. The inadequate performance of the Schwartze postauricular radical mastoidectomy is usually prompted by the surgeon's fear of injuring instrumentally one or more of the many vital anatomic structures which may be encountered blindly (1) when he attempts to reach and explore through the outer cortex of the mastoid process the deeply situated antrum for the purpose of becoming oriented with the temporal bone; (2) when he removes the posterior bony wall of the external auditory canal from without inward, directing the instrumentation toward the tympanic cavity, and (3) when he tries to explore and inspect the delicate vital anatomic structures within the tympanic cavity which are hidden from view by the pathologic contents.

Ever since the radical mastoidectomy was first described by Schwartze, young otologists have been traditionally warned of the inherently existing danger of injuring accidentally the lateral sinus, the dura of the middle and the posterior fossa, the posterior end of the external semicircular canal and the mastoid portion of the facial nerve when blindly searching for and exploring the antrum of the mastoid process through the outer cortex approach. Various means of attempting blindly to dodge these vital anatomic structures have therefore been taught. The danger of accidentally and blindly injuring the external semicircular canal and the tympanic portion of the facial nerve during the process of removing the posterior bony wall of the external auditory canal for the purpose of converting the antrum and the tympanic space into a continuous postoperative cavity has always been greatly stressed. Instruments called facial nerve protectors were devised for the purpose of blindly protecting the facial nerve from suffering such blind accidental injury. Otologists have been especially warned of the danger of injuring the facial nerve, dislocating the stapes and injuring the cochlear promontory in attempting to remove the pathologic contents and tissues from the tympanic cavity.

As a result of this generally accepted and practiced method of teaching how blindly to dodge the vital structures in the hope of indirectly saving them from accidental injury, there is developed in the average young otologist a fear complex which inhibits and prevents him from performing the Schwartze radical mastoidectomy adequately. Having been constantly trained to dodge the vital anatomic structures in order to avoid injuring them, when he has successfully opened the antrum of the mastoid process and removed the posterior bony wall of the external auditory canal and succeeded in dodging, often without even

visualizing, the vital structures involved, he usually calls it a day and quits. Having luckily avoided injuring any of the vital structures so far, he dares not tempt fate further and dodges the necessary exposure of the vital structures in the tympanum by leaving most of the pathologic processes within the tympanic cavity untouched, in the hope that nature will step in and finish what he had no courage to complete. However, nature only seldom obliges, and thus a permanently dry middle ear is too often not obtained as a result of the Schwartze postauricular radical mastoidectomy.

The adjective "radical" when applied to the Schwartze technic is therefore an exaggeration, for the way it is practiced by the average otologist makes the adjective "incomplete" more appropriate and more explanatory.

I should also like to call attention to the indisputable fact that the adjective "postauricular" as applied to the Schwartze radical mastoidectomy is a misnomer.

Mastoidotympanectomy cannot be performed through a postauricular incision alone. That incision must be supplemented with incisions made through the membranous lining of the posterior wall of the external auditory canal in order to create unobstructed, open and continuous postoperative accessibility of both the tympanic cavity and the mastoid process through the external auditory canal. The Schwartze technic is therefore in reality a combined postauricular and endaural technic and not just a postauricular technic.

However, it is a well established fact today that mastoidotympanectomy can be performed through endaural incisions alone without a supplementary postauricular incision. The postauricular incision is therefore not only unnecessary but also nonsurgical in principle since it involves a sacrifice of soft tissue greater than necessary for accomplishing the desired result.

Experience has taught me that in performing the mastoidotympanectomy the complete removal of the pathologic processes responsible for the persistent middle ear discharge without subjecting the vital anatomic structures to the danger of blind accidental injury can best be accomplished by observing the following three surgical principles:

1. The employment of endaural incisions only, for the surgical approach to the mastoid process and the tympanum instead of the combined postauricular and endaural incisions.
2. The abandonment of the dangerous search for the antrum of the mastoid process, which is not essential for the purpose of orientation.
3. The surgical exploration and exenteration of the pathologic process by instrumentation directed away from the visualized vital anatomic structures toward oneself instead of from oneself toward the unseen vital anatomic structures.

Instead of exploring and surgically treating the pathologic processes within the temporal bone through a pathway which requires blind dodging of vital anatomic structures to save them from injury, there is employed a pathway of approach which permits these vital structures to be visualized and thereafter utilized as guides toward the safe and successful exploration and surgical treatment of the lesions.

Based on these three surgical principles I have developed and employed for many years the following technic:

ENDAURAL SUBCORTICAL MASTOIDOTYMPANECTOMY

STEP I.—This procedure immediately exposes both the mastoid process and the tympanic portion of the temporal bone through endaural incisions only, instead of separately exposing first the mastoid process through a postauricular incision and secondarily exposing the tympanic space through endaural incisions. It is accomplished as follows: (*a*) Four endaural incisions through skin and periosteum are made:

First Incision.—Beginning at the tympanic ring, an incision is carried outward through skin and periosteum along the junction of the superior and posterior walls of the external auditory canal into the suprameatal membranous triangle and up to its apex.

Second Incision.—Beginning at the tympanic ring, an incision is carried outward through skin and periosteum along the junction of the inferior and posterior walls of the external auditory canal up to the lower end of the anterior margin of the concha.

Third Incision.—The skin and periosteum lining the innermost tympanic margin of the posterior wall of the external auditory canal is incised to connect the innermost ends of the first and second incisions at the tympanic ring.

Fourth Incision.—An incision is made through the skin, subcutaneous tissue and periosteum of the outer membranous portion of the posterior wall of the external auditory canal along the entire cartilaginous anterior margin of the concha, beginning with the outer end of the second incision, until it meets the outer end of the first incision in the apex of the membranous suprameatal triangle. (See fig. 1.)

(*b*) The skin flap created by the four just mentioned endaural incisions is removed with a periosteal elevator and conserved to be employed for skin-grafting the postoperative wound of the temporal bone. (See fig. 2.)

(*c*) The auricle is mobilized by freeing the intact postauricular skin and periosteum from its attachment to the cortex of the outer part of the mastoid process and freeing the antauricular skin and periosteum in the region of the posterior root of the zygoma with the use of a periosteal elevator.

(*d*) Self-retaining retractors are introduced into the membranous wound and held so that a complete exposure of the mastoid and tympanic portions of the temporal bone results. (See fig. 3.)

Fig. 1.—Four endaural incisions are made through skin and periosteum.

Fig. 2.—A skin flap is removed and saved for skin-grafting of the postoperative bony cavity.

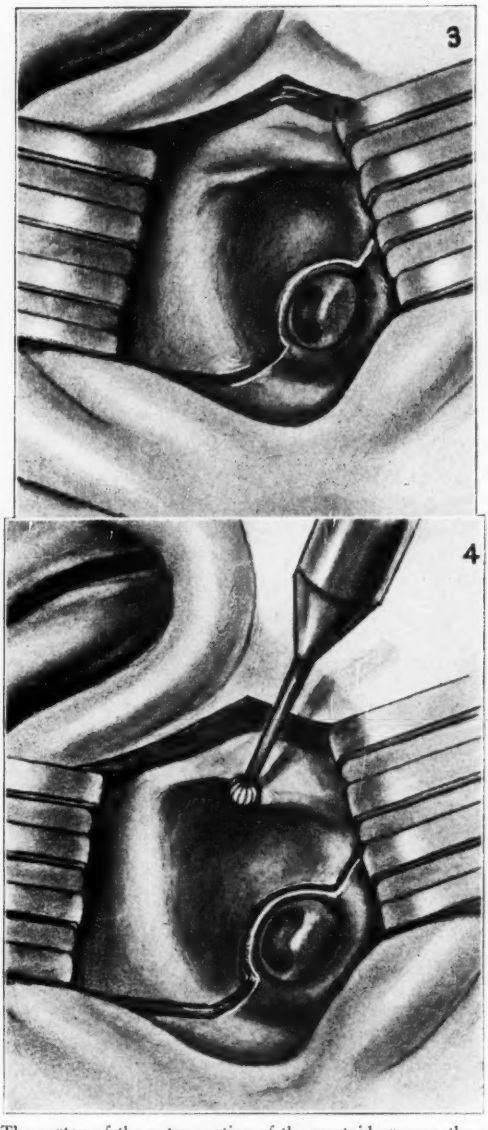


Fig. 3.—The cortex of the outer portion of the mastoid process, the spina Henle and the cortex of the entire anterior portion of the mastoid process can now be seen.

Fig. 4.—With an electrically driven dental cutting burr, spina Henle is removed, and the external auditory canal is widened.

(*c*) To afford a still greater surgical accessibility of the temporal bone through the external auditory canal the spina Henle is removed and the tympanic inferoposterior part of the posterior wall of the external auditory canal is shaved to meet the level of the mastoidal part of the posterior wall of the external auditory canal. (See fig. 4.)

STEP II.—This procedure safely exposes to view and renders accessible for surgical treatment all the existing lesions within the confines of both the mastoid process and the tympanic spaces without any searching for the antrum of the mastoid process. It is best accomplished as follows:

(*a*) The remnant of the tympanic membrane is removed from the sulcus tympanicus with a delicate, narrow periosteal elevator. The pathologic contents within the tympanum are thus exposed to view and rendered surgically accessible.

(*b*) By engaging the notch of Rivinus with a round, medium-sized, electrically driven, sharp, cutting dental burr and directing its course from within outward and constantly away from the vital anatomic structures and toward the cortex of the outer part of the mastoid process, the entire, comparatively thin cortex of the anterior part of the mastoid process, which enters into the formation of the posterior wall of the external auditory canal, is removed. Uninterrupted continuity of exposure is thus created between the tympanic cavity and the interior of the mastoid process. The antrum and cell structure of the mastoid process with all the pathologic contents are thus exposed to view and made surgically accessible. The danger of injuring the vital anatomic structures within the confines of the mastoid process, which accompanies the blind search for the antrum through the cortex of the outer part of the mastoid process is thus disposed of.

(*c*) The entire inner squamous part of the superior bony wall of the external auditory canal which forms the outer wall of the epitympanum is removed by engaging the innermost tympanic margin of the superior bony wall of the external auditory canal with an electrically driven, medium-sized, sharp-cutting dental burr and directing it from within outward, away from the vital anatomic structures and toward oneself. The tegmen of the middle fossa in the region of the epitympanum thus becomes continuous with the roof of the external auditory canal. The remnants of the diseased incus and malleus with all the other pathologic contents of the epitympanum are thus exposed to view and rendered surgically accessible.

(*d*) The inner tympanic portion of the inferior bony wall of the external auditory canal which forms the outer wall of the hypotympanum is removed by engaging its innermost margin with the same type of electrically driven burr and directing the burr's activity from within outward away from the vital anatomic structures and toward oneself, until the floor of the hypotympanum becomes continuous and on a level

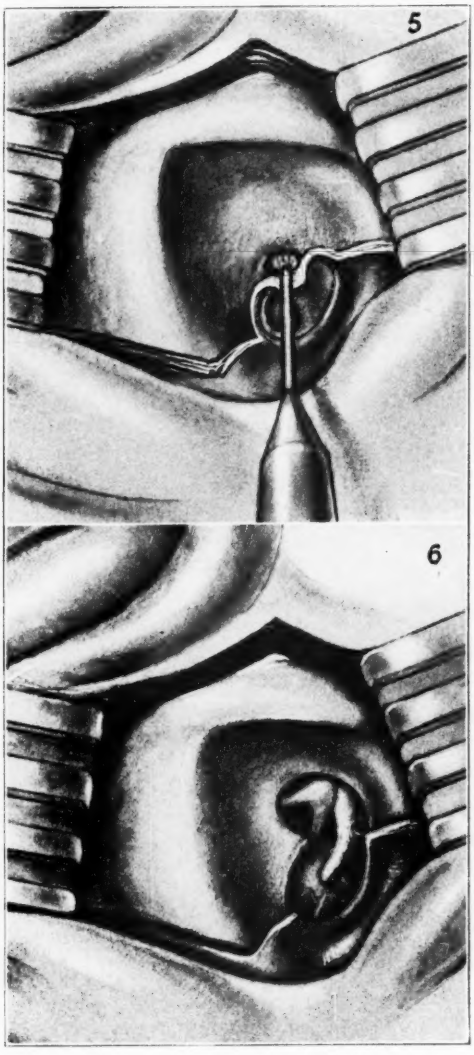


Fig. 5.—The tympanic inner margin of the posterosuperior bony wall of the external auditory canal is engaged with a small, electrically driven cutting burr and the removing of the cortex of the anterior part of the mastoid process from within outward is begun.

Fig. 6.—With a small, electrically driven burr the tympanic margin of the superior wall of the external auditory canal has been removed. The incudomalleolar joint within the epitympanum is exposed to view.

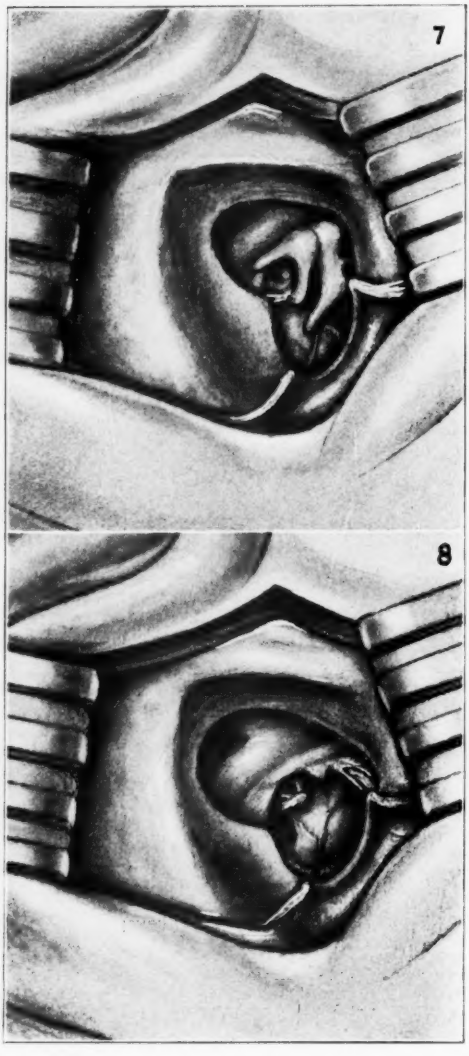


Fig. 7.—The cortex of the anterior part of the mastoid process has been further removed with the burr, working from within outward and exposing to view the incudostapedial joint and the external semicircular canal.

Fig. 8.—The incus, the malleus and the remnant of tympanic membrane have been removed, exposing to view the canal of the facial nerve, the processus cochleariformis, the stapes in situ, the round window niche and the cochlear promotory.

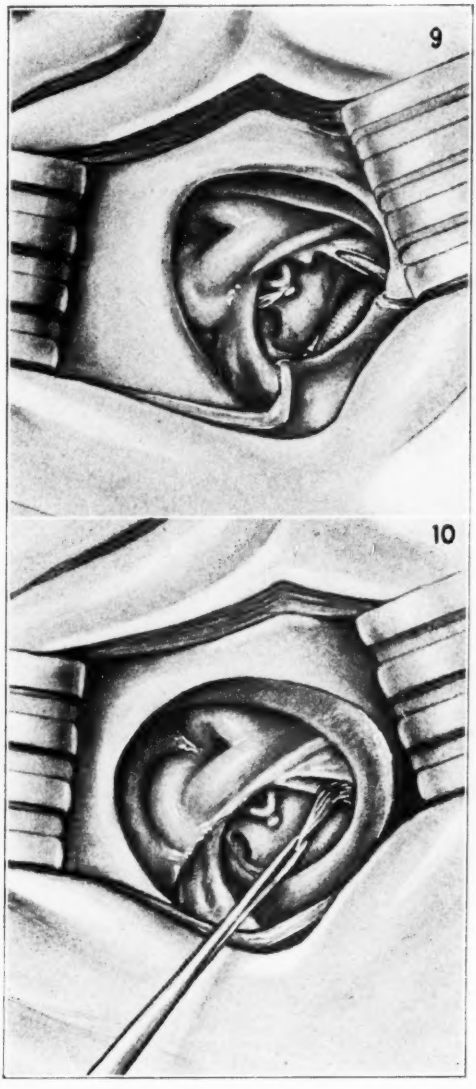


Fig. 9.—By removing the cortex of the anterior part of the mastoid bone still further in exenterating the mastoid cell structure, the three semicircular canals are exposed to view. The perieustachian cells and the pericarotid cells have been removed, exposing to view the semicanal with the infected tensor tympani muscle and the carotid canal.

Fig. 10.—The floor of the external auditory canal has been leveled to the floor of the hypotympanum. The diseased mucoperiosteum lining the typmpanic cavity has been removed. The removal of the infected tensor tympani muscle from its semicanal is begun.

with the floor of the external auditory canal. The pathologic contents of the hypotympanum are thus exposed to view and rendered easily accessible to surgical treatment. (See figs. 5, 6 and 7.)

STEP III.—In this step all the vital anatomic structures normally present within the mastoid process and the tympanic space are safely exposed to view by removing all the pathologic processes which surround and involve them, through careful instrumentation directed away from the vital structures, with the aid of proper illumination and adequate magnification.

In order to obtain a permanently dry middle ear and to avoid the possibility of future intracranial extension of the infection of the middle ear, it is absolutely essential that all the existing pathologic contents and tissues within the mastoid process and tympanic spaces should be removed. The hope of accomplishing complete removal of the pathologic process rests on the thoroughness of the search for, and exploration of, the existing pathologic involvements.

Unless the mastoidotympanectomy includes a complete exenteration of the cells of the mastoid process, including the perilabyrinthine cell structure, with exposure and surgical treatment, if necessary, of the entire inner bony table in the regions of the middle fossa, the posterior fossa, the lateral sinus, the basal vestibular labyrinthine portion of the petrous pyramid and the transmastoid course of the facial nerve, the result desired must remain within the realm of doubt. A thoroughly complete mastoidectomy must always be part of the mastoidotympanectomy. By the same token neither can the end result of a mastoidotympanectomy be anything but doubtful unless the entire inner bony table of the tympanum, epitympanum and hypotympanum is exposed to view and explored. In addition to removing granulations, polypi and cholesteatomas from the tympanic cavity it is also essential to remove any granulations that may be present in the region of the oval and round window niches. The perieustachian cells should be removed, and the pericarotid cells should be removed as well. The osseous tympanic portion of the eustachian tube should never be curetted, in order to avoid osteomyelitis resulting therefrom. The processus cochleariformis and the entire infected tensor tympani muscle should be removed from its semicanal. The diseased mucoperiosteum lining the inner bony walls of the tympanic space should be removed and the tympanic inner bony walls exposed to view. The cochlear promontory, the canal of the facial nerve, the epitympanic tegmen of the middle fossa and the hypotympanic bony dome of the bulb of the jugular vein and the bony canal of the carotid artery should be carefully inspected and any necrotic areas observed should be surgically treated. (See figs. 8 to 11.)

STEP IV.—Rapid and complete healing is promoted by skin-grafting the postoperative wound of the temporal bone which has been freed from all the pathologic material which surrounded and invested it. (See figs. 12 and 13.)

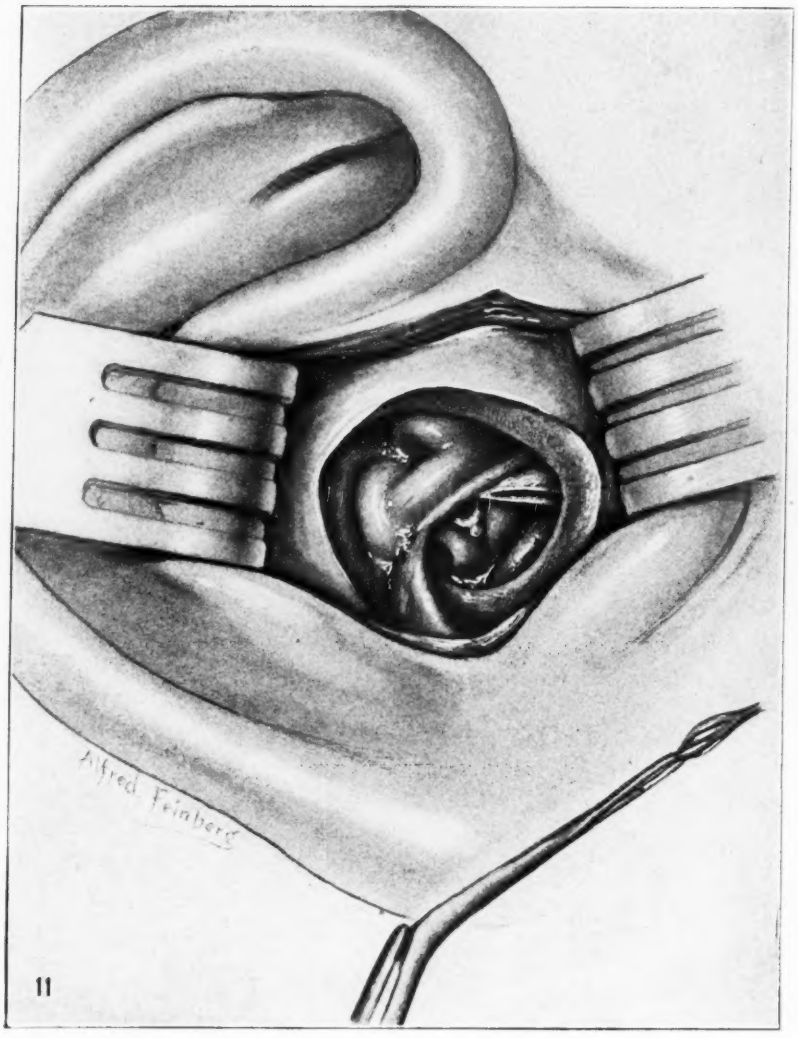


Fig. 11.—Cells of the mastoid process have been exenterated. The three semicircular canals have been defined. The floor of the external auditory canal has been leveled to the floor of the hypotympanum. The pericarotid and perieustachian cells have been removed. The infected tensor tympani muscle has been completely removed from its semicanal.

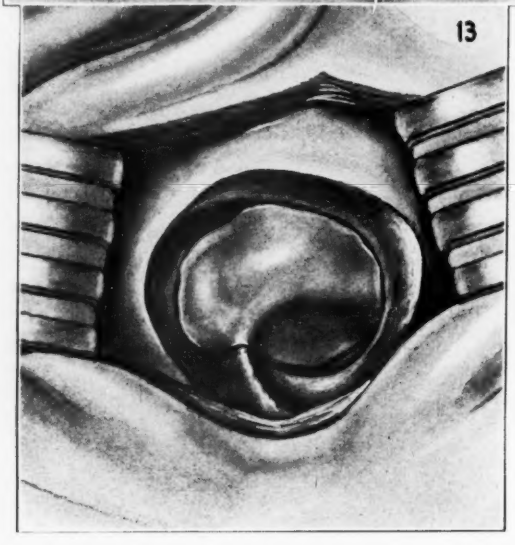


Fig. 12.—The cortex of the outer part of the mastoid process has been removed, exposing to view the completely exenterated mastoidotympanic wound.

Fig. 13.—The postoperative mastoidotympanic cavity is skin grafted with the skin flap which was removed from the external auditory canal.

The mastoidotympanic postoperative cavity is skin-grafted with split thickness skin grafts. When the cavity is not too large, as it is usually when the mastoid process was small and sclerosed, the skin flap obtained as a result of the four endaural incisions and carefully trimmed to the desired thickness is more than sufficient to cover the entire postoperative cavity. The cavity is packed and the skin graft is held in position with ½ inch (1.27 cm.) gauze strips dipped in sulfathiazole jelly. The packing is removed five days after operation. Sulfathiazole powder is insufflated into the cavity every other day thereafter. The patient leaves the hospital on the seventh postoperative day. The mastoidotympanic wound is completely epithelized and dry as a rule between four and five weeks after operation.

ADVANTAGES

1. By abandoning the blind search for the antrum of the mastoid process with instrumentation directed from without inward through the cortex of the outer part of the mastoid process and instead exploring the confines of the mastoid process by first removing the anterior cortex with instrumentation directed from within outward, blind accidental injury of the vital anatomic structures within the mastoid process can always be avoided.

2. By directing all one's instrumentation within the mastoid process and the epitympanum, tympanum and hypotympanum away from the vital anatomic structures toward oneself, all the pathologic processes encountered can be removed without danger of injuring these anatomic structures, provided proper illumination and adequate magnification are also employed. A permanently dry middle ear will, as a rule, be the reward of such thorough exenteration.

3. Since the postauricular incision has been avoided, the postoperative occurrence of a postauricular fistula is no longer possible.

4. The Lempert endaural subcortical mastoidotympanectomy technic, unlike the Schwartze postauricular radical mastoidectomy, is based on anatomic lines and sound surgical principles. Whereas, the successful employment of the Schwartze technic is reserved for the exceptionally skilful otologist who has learned through bitter and prolonged experience how to cope with all its inherent dangers, any well trained otologist of average skill though young in experience can successfully perform the endaural subcortical mastoidotympanectomy without being handicapped by the mental hazards which prevent him from performing the Schwartze radical mastoidectomy successfully.

By adopting the endaural subcortical technic, the otologist may reasonably assure the patient with otitis media purulenta chronica that on submitting to mastoidotympanectomy his desire of obtaining a permanently dry middle ear will, as a rule, be fulfilled, and may volunteer the information that with such a result intracranial extension of the infection will also be avoided.

ROUND WINDOW MEMBRANE OF THE COCHLEA

Experiments Demonstrating Its Physical Responses

H. G. KOBRAK, M.D., Ph.D.
CHICAGO

ONE OF the fundamental difficulties in the understanding of hearing is the lack of knowledge of the physical characteristics of the aural structures.

Improved knowledge of the physics of the cochlea not only would give a more direct understanding of the processes found in the inner ear but would give the physicist and the mathematician the necessary foundation for mathematical-physical interpretations. The mathematical treatises have been handicapped in the past because the mathematician did not possess the necessary knowledge of physical constants to formulate his initial equations. The most splendid mathematical solution of any problem is unsatisfactory if the formulation of the initial equation contained physical errors. Many times biomathematicians working on the ear were defeated in their endeavors because the magnitude of dampening, elasticity, tension and other fundamental physical qualities of the anatomic structures could not be determined with the available methods.

Experiments were devised to furnish experimental data on the physical properties of certain structures of the inner ear. This paper is confined to the subject of the round window membrane. The literature shows great confusion as to the function of the round window. The majority of students of hearing consider the membrane of the round window as the necessary compensating area for the vibrating fluid in the cochlea. However, there is still a considerable number of those who believe that the round window is the portal of entry for sound. The question was complicated still more by the fenestration operation. In the otosclerotic patient the entering of sound energy through the oval window is impossible. Therefore, the entering of the stimulus through the round window is more a possibility in the sclerotic than in the normal ear. The need for greater knowledge of the physics of the inner ear cannot be demonstrated better than by citing the surgical treatment of deafness as it was practiced for a number of years by Hughson and Crowe.[1] The rationale of this treatment was

From the Division of Otolaryngology, University of Chicago.

1. Hughson, W., and Crowe, S.: Experimental Investigation of the Physiology of the Ear, Acta oto-laryng. **18**:291, 1933.

the assumption that the normal tension of the normal round window membrane is too low. Therefore, Crowe and Hughson concluded that the normal physical condition of the round window does not represent the optimal condition for sound conduction. The next step was that of increasing the tension of the round window by surgical means. It has been doubted by other observers [2] that the basic assumption of Hughson was correct. The surgical treatment of the round window has been discontinued as far as I know. However, the basic question as to the normal and the optimal tension of the round window membrane has not been solved.

A search of the literature of the last fifty years revealed that no attempt has been made to measure the physical characteristics of the membrane of the round window. Extensive anatomic or histologic studies have not been reported either. For example, no measurements of such an elementary quantity as the thickness of the membrane were found in the literature.

For this reason, a series of anatomic and histologic studies preceded the physiologic investigations. The size, the shape, the thickness, the texture, the weight and the specific gravity of the round window membrane were studied. The physiologic experiments were performed on fresh human cadaver specimens and on living rabbits.

Utilization of fresh human cadaver specimens for physiologic acoustical work has proved valuable. The fresh cadaver specimen lacks the normal tonus of the muscles of the middle ear. However, the elastic qualities of membranes and ligaments are unchanged, according to experimental evidence. Frank [3] has measured the volume elasticity coefficient of the tympanic membrane and proved that the elastic qualities of that membrane are the same in a living person and in the fresh specimen. Von Békésy [4] recorded the natural frequencies of the living normal ear drum and compared them with the resonance frequency of the ear of the cadaver. He found that both the natural frequency and the dampening are identical. He concluded, therefore, that "the observations made on the fresh cadaver specimen have general application provided certain precautionary measures are taken."

The membrane of the round window is rather hidden. While the niche of the round window has been seen by every otologist innumerable times, a gross view of the entire membrane requires considerable

2. Culler, E.; Finch, G., and Girden, E.: Function of the Round Window in Hearing, Am. J. Physiol. **111**:416, 1935. Milstein, T. N.: Zur Technik der Einmauerung des runden Fensters, Acta oto-laryng. **25**:387, 1937.

3. Frank, O.: Die Leitung des Schalles im Ohr, Sitzungsb. d. Gesellsch. f. Morphol. u. Physiol. **24**:34, 1923.

4. von Békésy, G.: Ueber die mechanisch-akustichen Vorgänge beim Höhren, Acta oto-laryng. **27**:281, 1939.

careful dissecting (fig. 1). Most otologists therefore visualize this membrane only as a histologic entity seen on cross sections of their specimens of the temporal bone. The histologic examination has the disadvantage, of course, that the tissue has been subjected to extensive chemical changes inherent in the common histologic technic. Figure 1 shows the round window membrane of a temporal bone of a fresh

Fig. 1.—The round window membrane of the cochlea is a thin membranous structure occluding the bony aperture between the scala tympani and the middle ear cavity. The area of the membrane is about 2 sq. mm. The membrane is not strictly round.

human cadaver. It is evident from this picture that the membrane is not exactly round. The name "triangular membrane" would be appropriate. The cochlear window has therefore been called foramen triquetrum in the literature.[5] The physiologic role of the round window

5. Denker, A., and Kahler, O.: Handbuch der Hals-Nasen-Ohrenheilkunde, Berlin, Julius Springer, 1926, vol. 6, p. 459.

is difficult to study because of the physical arrangement. The membrane represents a boundary between a fluid system and an air space. The physics of the fluid system in the inner ear is inadequately understood. All physical experiments in which the membrane might be studied in situ would contain variable and unknown factors of the membrane as well as others of the cochlea. For the purpose of physical analysis it seemed essential, therefore, to study the membrane separately, with air on each side of the membrane. This is technically possible. The name "isolated round window membrane" will be used for this preparation (fig. 2).

SETUP FOR EXPERIMENTS ON THE ISOLATED ROUND WINDOW MEMBRANE

Fresh human cadaver ears were used. The middle ear was opened and the round window exposed. With a dental drill, the round window region was carefully separated from its surrounding. A ring of bone several millimeters thick, containing the round window membrane, was removed. A glass tube of proper diameter was sealed over the ring. By this procedure a specimen was obtained which consisted of a canal (glass tube), the end of which was closed by the membrane of the round window. A syringe was used to produce static pressure changes in the glass tube. The pressures were measured by a water manometer. On the other side of the round window membrane a small mirror was attached. The location of the mirror was about halfway between the center and the edge of the membrane.[6] The mirror was 0.030 inch long and 0.015 inch wide (0.75 by 0.375 mm.). The rotatory movements of the mirror could be recorded by the deviation of a light beam (fig. 2). In addition to static pressure changes, acoustic stimuli could be sent into this system. The response of the membrane to tones was measured.

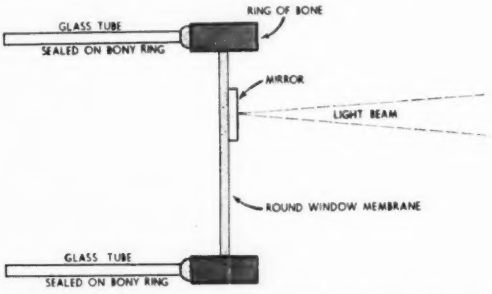


Fig. 2.—Scheme illustrating the isolated round window specimen. The round window membrane and the adjacent bone tissue are removed from the cochlea of a fresh human cadaver ear. A glass tube is attached to the bony ring and sealed tightly. A small mirror is attached to the opposite side of the round window membrane. Sound pressures as well as changes of static pressure are conducted into the glass tube.

6. The optimal distance (d) from the center of the membrane is $d = \frac{R}{\sqrt{3}}$

RESPONSE OF THE ISOLATED ROUND WINDOW MEMBRANE TO STATIC PRESSURE CHANGES AND A TONAL FREQUENCY

Figure 3 shows the response of the round window membrane to changes of static pressure. On comparing the excursions due to

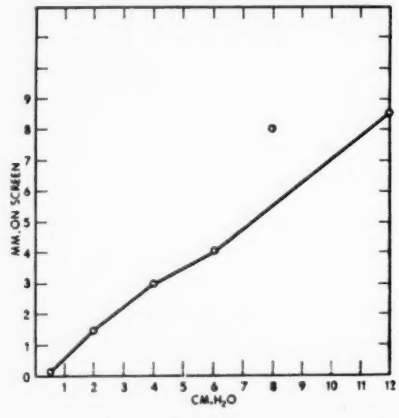


Fig. 3.—The response of the isolated human round window membrane to changes of static pressure. A bulging of the membrane results in a rotation of the mirror attached to the membrane. The resulting deflection of a light beam is measured on a screen. In each experiment the distance between specimen and screen was determined. By simple trigonometry it was possible to calculate the rotation of the mirror from the deflection of the light beam measured on the screen. In turn the amplitude of the excursion of the membrane could be estimated in regard to its order of magnitude if the position of the mirror on the membrane was known.

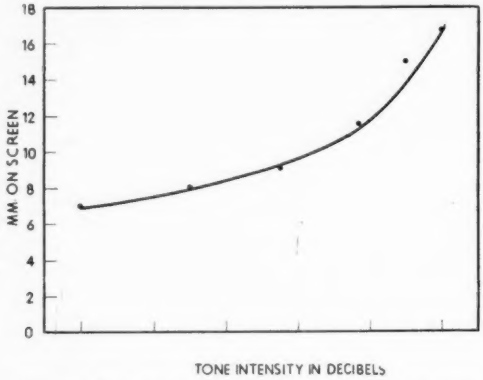


Fig. 4.—Acoustic vibrations of the isolated round window membrane. The experimental setup is described in figure 2. The abscissa is the intensity of the tone C.[2] The ordinate designates millimeters of deflection on the screen.

positive, or plus, pressures with those due to negative, or minus, phases it was seen that for the range of pressure changes which were used and with the sensitivity of the experimental setup the two phases produce equal amplitudes. This finding is important, for similar experiments done on the round window membrane in situ show distinct asymmetry of amplitudes. By using the isolated round window membrane it is possible to show that this asymmetry is not due to the physical characteristics of the fenestra rotunda but is due most likely to those of the middle ear apparatus.

When a tone was conducted into the specimen, a response curve such as that seen in figure 4 was obtained.

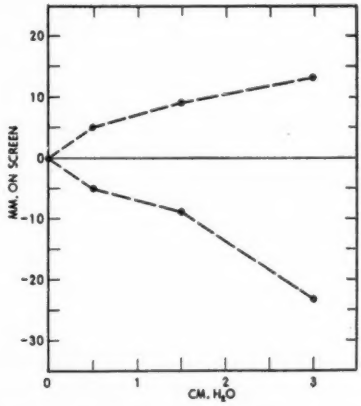


Fig. 5.—The experimental setup was as follows: A fresh human cadaver ear with the round window membrane in situ; a small mirror attached to the round window membrane; changes of static pressure produced in the canal of the outer ear. Positive amplitudes are recorded above the zero line; negative amplitudes, below the zero line. Note the asymmetry of the response curves: Negative phases of pressure in the external auditory canal produce greater amplitudes than positive phases.

RESPONSE OF THE ROUND WINDOW MEMBRANE IN SITU TO STATIC PRESSURES AND ACOUSTIC STIMULI

The next step was the determination of the fenestral response to stimuli applied in the outer auditory meatus. Cadaver specimens were prepared in such a way that the whole outer and middle ear were intact but the round window niche was exposed from below. A mirror was attached to the round window membrane. Static pressure changes or tones, respectively, were conducted by means of a tube into the canal of the outer ear. The curve for static pressures is seen in figure 5.

It is evident that a negative pressure in the external auditory canal produces a greater amplitude of movement of the round window than an equally strong positive pressure. The curve shows that the light beam was deflected 23 mm. on the screen by a negative pressure of 3 cm. of water. On the other hand, a positive pressure of 3 cm. of water produced a deflection of only 13 mm. on the screen.

It is easy to calculate the degree to which the mirror rotates on the membrane from the measured values of light deflection. By simple trigonometry it is evident that the angle of rotation of the mirror due to a minus pressure in the outer canal of the ear was 0° 39′ while the corresponding plus pressure produced a rotation of 0° 22′. It is possible to estimate the order of magnitude of the amplitude of the center of the round window membrane. If one assumes a radius of 0.6 mm. for the membrane, one obtains [7] the following amplitudes.

Minus pressure of 3 cm. of water in external canal: 0.00678 mm. of amplitude
Plus pressure of 3 cm. of water in external canal: 0.0029 mm. of amplitude

Acoustic amplitudes can be measured similarly. The proportion of plus to minus amplitude is seen in figure 6. For small values no attempt was made to differentiate between plus and minus response. The three columns on the left in figure 6 are therefore not subdivided. Larger amplitudes due to greater tonal intensities in the external auditory canal were easily subdivided into the larger negative and the smaller positive phase. The proportion between the two is about 7 : 5.

The asymmetry of the ossicular chain is similar to that observed on the round window membrane. Values for positive and negative movements of the tympanic membrane or hammer vibrations show a similar ratio. As seen in the experiments on the isolated round window, the asymmetry is not due to the physical characteristics of the membrane. It is to be assumed, therefore, that the asymmetry observed in the round window membrane is due to the physical properties of the middle ear. This is experimental evidence that within this range of stimuli, at least, the cochlea is stimulated normally by an asymmetric signal. This fact could be used for an explanation of the fact that bioelectrical phenomena of the inner ear show a greater response to the negative phase of the pressure exerted in the outer auditory canal.

The optical recordings of the movements of the round window membrane were made by using one of the smallest and lightest mirrors

7. The following formula was used in this calculation:
$Y = R \times \sin \alpha$
Where
Y = amplitude
R = radius of membrane
α = angle of rotation

that could be obtained through commercial channels. Their weight is about 10 mg.[8] When one of these mirrors is attached to a membrane, a new mass and stiffness factor is introduced. It is difficult to compute mathematically whether the change is significant or whether it may be neglected.

A second experimental observation different in method may be used to decide this important question. It is more practical than extensive mathematical calculations. It consists in the direct recording of amplitudes by means of moving picture film.

With the moving picture recording, furthermore, no interference with the delicate anatomic structures is necessary. As described in a previous publication,[9] moving picture films have been evaluated quantitatively.

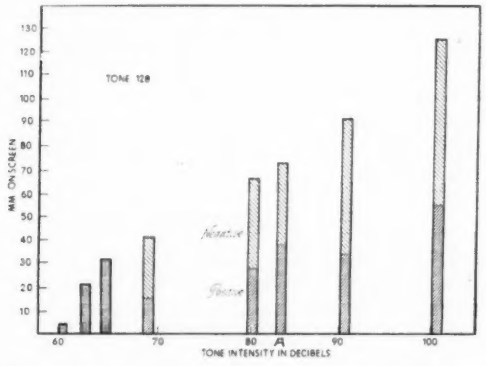


Fig. 6.—Demonstration of the asymmetric response of the round window membrane of the cochlea (fresh human temporal bone used). The columns represent the response of the round window membrane to the tone of 128 double vibrations per second at various intensities. The lower part of the column (stripes running from right to left) represents the response to positive acoustic pressure in the outer auditory canal; the upper part (stripes running from left to right), the response to the negative phase of the tonal frequency. The amplitude of the vibration of the round window membrane is greater for the negative phase. The differences represented by the three columns on the left were too small for subdividing between plus and minus phase. At *A* the response of the isolated round window membrane is given; plus and minus amplitude are about equal. Note: The linear response of the round window membrane to the sound is demonstrated by the height of the column. An imaginary line pulled through the left upper corner of the columns is fairly straight.

Well defined light points on the round window membrane, moving during acoustic stimulation (stroboscopic illumination), were used.

8. The information concerning weight was obtained from the General Electric Company by special communication.

9. Kobrak, H. G.: New Method of Scientific Investigation of Inner Ear, Laryngoscope **57**:247, 1947.

A central light point is followed on the screen, and its amplitude on the screen is measured. By simple trigonometry, the real amplitude of the vibrating part is defined as:

$$A = \frac{S \times \sqrt{2}}{c}$$

Where

A = the real amplitude of the point of the membrane
S = the optically enlarged amplitude as projected on the screen,
C = the optical magnification factor (observation of membrane under an angle of 45 degrees)

The experiments demonstrated in figures 3 to 6 and those of the moving picture are not identical. Since the sensitivity of the moving picture recording is not as great, larger stimuli were used. Naturally, the resulting amplitudes are larger. The comparison, however, does show that the order of magnitude obtained by the one method is in agreement with that obtained by the other. The amplitude of the round window was found between 0.032 mm. in one instance and 0.077 mm. under strongest stimulation. This corresponds to a static pressure (determined by extrapolation) of about 50 cm. of water for the strongest stimulus.

FENESTRAL SOUND CONDUCTION

The question whether sound is conducted directly through the round window has been debated for many decades, perhaps even for centuries. Schelhammer[10] discussed it in a book published in 1684. A number of authors[11] have stated their opinion that the cochlea receives its acoustic stimuli through the membrane of the round window. A larger number of investigators, however, consider the round window only as a compensatory opening for the vibrating fluid column of the inner ear.[12]

10. Schelhammer, G. C.: De auditu liber unus, quo plerorumque omnium doctorum sententiae examinantur, et auditus ratio, nova methodo, ex ipsius naturae legibus, explicatur, Lugd. Bat., P. de Graaf, 1684.

11. Sappolini, cited by Politzer, A.: Geschichte der Ohrenheilkunde, Stuttgart, Ferdinand Enke, 1913, vol. 2, p. 48. Lucae, A.: Beiträge zur Lehre von den Schallempfindungen, Arch. f. Ohrenh. **79**:246, 1909. Secchi, G.: La fenestra rotunda, Arch. ital. di otol. **12**:49, 1901. Beyer, H.: Studien über den sogenannten Schalleitungs-apparat bei den Wirbeltieren und Betrachtungen über die Funktion des Schnecken Fensters, Arch. f. Ohrenh. **77**:79, 1908. Zimmermann, G.: Zur Physik und Physiologie der Schallbewegung, Arch. f. d. ges. Physiol. **144**:7, 1912.

12. Bezold, F.: Experimentelle Untersuchungen über den Schalleitungsapparat des Ohres, Arch. f. Ohrenh. **77**:19, 1908. Buck, A.: Untersuchungen über den Mechanismus der Gehörknöchelchen, Arch. f. Augen- u. Ohrenh. **1**:121,

Observations of von Békésy [12] show that a person without tympanic membrane or ossicles hears the acoustic stimulus in opposite phase as compared with a normal observer. This difference of phase is understandable because ossicular conduction delivers the tone to the oval window and the scala vestibuli, while round window conduction delivers it to the scala tympani. The basilar membrane must vibrate in opposite phase according to the pathway of conduction by which the sound entered the cochlea.

The development of methods permitting responses of the ear to be measured objectively offers a new answer to the old problem. The experimental setup used in this study was as follows:

A fresh human cadaver ear was opened from below and the round window niche exposed. A glass tube was placed in the niche and fastened and sealed with plaster of paris. A second tube was inserted in the canal of the outer ear

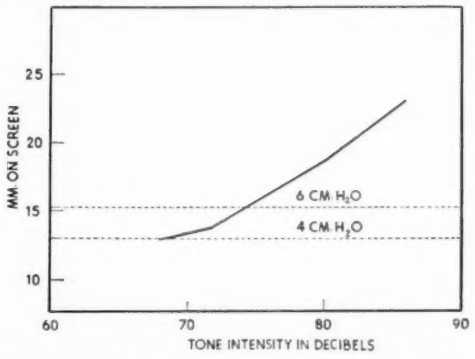


Fig. 7.—Fenestral sound conduction. A fresh human temporal bone was used. The round window niche was exposed from below and a glass tube inserted and sealed in the niche. The cochlea was stimulated by "reversed sound conduction"; i. e., sound entered through the round window membrane. Compensatory movements of the stapes and the ossicular chain are measured by the recording of the vibrations of the incus. The abscissa is the intensity of the tone; the ordinate is the rotation of the incus expressed in millimeters measured on the screen. The two broken lines represent changes of static pressure applied through the round window membrane, with the corresponding rotation of the incus.

1870. Burnett, C. H.: Untersuchungen über den Mechanismus der Gehörknöchelchen und der Membran des runden Fensters, ibid. **2**:64, 1872. Chilow, K. L.: Zur Frage über die Ausgleichung des Labyrinthdruckes, Ztschr. f. Hals-, Nasen- u. Ohrenh. **5**:404, 1923. Weber-Liel: Der Aquaeductus cochleae, Monatschr. f. Ohrenh. **13**:33, 1876. Huizinga, E.: Die Tulliosche Reaktion im Zusammenhang mit der Funktion des Mittelohrapparates, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **145**:447, 1938.

13. Békésy, G.: Zur Physik des Mittelohres und über das Hören bei fehlerhaftem Trommelfell, Akust. Ztschr. **1**:13-23, 1936.

and fastened. The tegmen tympani was removed partly and a small mirror placed on the body of the incus. The vibrations of the incus were recorded optically. Figure 7 shows a curve of fenestral sound conduction. It was also possible to conduct tones either through the outer ear or through the round window niche. A direct comparison of the degrees of effectiveness of the two modes of sound conduction was thus possible.

The tubes conducting to the outer ear and to the round window niche were of equal length, equal diameter and equal material. With this arrangement, a certain tone was conducted through the outer ear and the amplitude of the vibration of the incus measured. By a turn of the switch the same tone was then conducted through the round window membrane and again the vibration of the incus was measured. In the former case one has the conventional ossicular sound

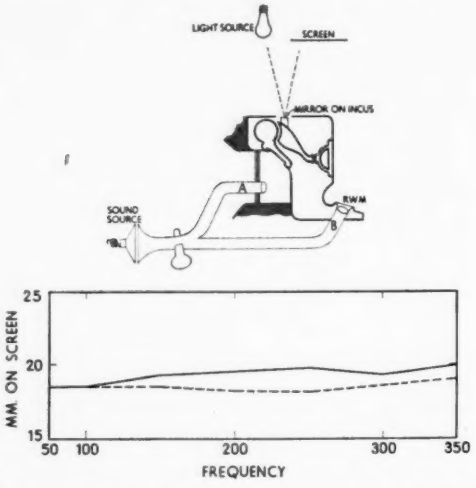


Fig. 8.—Comparison between meatal and fenestral sound conduction. Sound can be directed either through tube *A* into the outer auditory canal or through *B* directly against the round window membrane (*RWM*). The vibrations of the incus in response to meatal and in response to fenestral sound conduction were measured. The solid line represents amplitude of vibration due to meatal conduction; the broken line, that due to fenestral conduction. The two amplitudes are practically equal.

conduction. In the latter case the sound conduction is reversed; one deals with fenestral sound conduction.

The experimental results were rather definite (fig. 8). The vibrations of the incus are about equal in ossicular and fenestral conduction. The difference in phase was obvious in optical recordings. It was possible to use the same experimental setup on the living animal. Sound was conducted by tube into the round window niche of a rabbit. The tensor reflex of the opposite ear was used as indicator of cochlear

function. There was a good tensor reflex for sounds conducted into the round window niche. All these experiments were carried out with the ossicular chain intact.

SUMMARY

The round window membrane is a part of the sound-conducting system of the ear which has not been investigated extensively in the past.

For analysis of physical properties, the membrane was removed from the cochlea (stretched in a bony ring) and subjected to static and dynamic tests. This specimen was termed the "isolated round window specimen." Elasticity curves were obtained for static pressures and acoustic stimuli.

The behavior of the round window membrane in situ constitutes a complex physical problem: that of a membrane with fluid on one side and an air-containing cavity of barometric or near barometric pressure on the other side. The membrane is coupled to the ear drum and ossicular chain and shows some of their physical characteristics—for example, the asymmetry. Static and acoustic curves of the membrane in situ are demonstrated.

A comparison of the amplitudes of the stapes and the round window membrane shows that the round window membrane executes larger excursions than the stapes. Between the tympanic membrane and the stapes the amplitude of vibration diminishes, but it is increased again between the oval and the round window.

For the frequency range tested, the inward movement of the round window membrane is greater than the outward movement. This asymmetry is not maintained in the isolated round window specimen.

Experimental evidence is brought forward which shows the response of the cochlea to fenestral sound conduction (sound entering the cochlea through the round window membrane). A quantitative comparison between meatal and fenestral sound conduction is given.

950 East Fifty-Ninth Street.

EFFECTS OF ALLERGY ON THE ETHMOID SINUSES

HARRY P. SCHENCK, M.D.
PHILADELPHIA

IN ALLERGY of the upper respiratory tract the soft tissue of the turbinate body is the primary shock organ. The ethmoid air cells and the maxillary sinuses are the first of the pneumatic cells of the skull to participate in allergic response because they are the air spaces most intimately related to the inferior and the middle turbinate bodies. The frontal sinuses tend to become involved later, and to a lesser degree, because of their less intimate relation to the turbinate bodies. Allergic changes in the soft tissue of the sphenoid sinuses are a comparative rarity because the orifices of these air spaces are still more remote.

The order and degree of allergic involvement of the sinuses can be gaged to some extent by examination of the paranasal sinuses of patients with bronchial asthma.[1] A group of these patients showed a high incidence of sinus disease in both a roentgenographic study (80.5 per cent) and a clinical study (67 per cent). In both examinations, mucosal abnormality was most frequent in the maxillary sinuses and appeared next, in order of decreasing frequency, in the ethmoid, frontal and sphenoid sinuses. (Whether the maxillary sinuses or the ethmoid air cells are first involved cannot be determined with absolute certainty because the early phase of allergic change in mucous membrane is more difficult to detect in the ethmoid cells than in the maxillary sinuses.)

There is little evidence to support the concept that allergic changes commonly occur in the paranasal sinuses prior to allergic changes in the turbinate bodies. On the other hand, it has become obvious that, once allergic alterations have taken place within the sinuses, these alterations may progress until an irreversible change has taken place in the tissue, which is no longer appreciably affected by abnormalities in the turbinate bodies.[2]

The primary allergic response in the upper respiratory tract usually appears in the tissue of the turbinate body and may be initiated by direct contact with an allergen which has gained entrance to the nasal passages or by the more indirect contact with blood-borne antigens absorbed from the gastrointestinal tract. In a sensitized person, absorption of

1. Kern, R. A., and Schenck, H. P.: The Relative Efficiency of the Clinical and Roentgenologic Methods for Sinus Disease Diagnosis, Am. J. M. Sc. **178**:168 (Aug.) 1929.

food or drugs in the gastrointestinal tract may initiate a very positive allergic response in the tissue of the turbinate body, but the role of blood-borne allergens is apt to be overshadowed by the more frequent effects of air-borne allergens. In an occasional patient a characteristic curious, granular, pale stippling of the posterior portion of the middle part of the turbinate body is the first evidence in the upper respiratory tract of food sensitization.[2]

The allergic changes in the turbinate bodies consist primarily of thickening and hyperplasia of the epithelium, edema of the basement membrane and edema and eosinophilic infiltration of the stroma. Actually, all these alterations are secondary to certain vascular phenomena precipitated when a specific allergen comes in contact with sensitized tissue. At least a portion of the mechanism thus brought into play was demonstrated in observations on the living tissues of animals, made under the high powers of the microscope.[3] The injection of horse serum, or of red blood corpuscles from fowl, into a rabbit sensitized to either antigen has the folowing effects: (1) the arterioles contract, blocking the circulation; (2) the consistency of the endothelium changes, so that the leukocytes adhere to the walls of the capillaries and venules in large numbers and emigrate into the surrounding tissue; (3) a change occurs in the leukocytes, so that they become cohesive, frequently occluding the venules and capillaries and sometimes forming leukocytic emboli; (4) no contraction of the blood capillaries or the small

2. An exception to the usual train of events has been described by Proetz (Sudden Allergic Reactions in the Maxillary Sinuses, J. Allergy **1**:324 [May] 1930), who observed sudden pronounced increase in the thickness of the mucosa of the maxillary sinus during an asthmatic attack, while a patient was undergoing roentgenologic studies and iodized oil U. S. P. was present in the sinus. He suggested that the trauma incident to the introduction of contrast mediums might play a role in such a reaction. Similar bizarre allergic reactions may occur elsewhere in the respiratory tract. For example, a 50 year old physician, while inoculating rats during an experimental investigation, suddenly became hoarse, then aphonic and finally dyspneic. When examination was made ten minutes later, the obstructive dyspnea was so extreme that preparations were made for tracheotomy. The right vocal cord was pallid, edematous and in contact with the left false vocal cord. Forceful displacement of the right cord to the right revealed the left vocal cord to be essentially normal. Subcutaneous administration of a solution of epinephrine was followed within ten minutes by subsidence of the edema of the right vocal cord. Subsequent cutaneous tests demonstrated that he had a violent reaction to rat hair.

3. Abell, R. G., and Schenck, H. P.: Microscopic Observations on the Behavior of Living Blood Vessels of the Rabbit During the Reaction of Anaphylaxis, J. Immunol. **34**:195 (March) 1938; The Behavior of Living Blood Vessels of the Rabbit During the Reaction of Anaphylaxis, Anat. Rec. **70**:1 (March) 1938. Schenck, H. P., and Abell, R. G.: The Anaphylaxis Reaction: Tissue Changes as Observed in Living Tissue in the Rabbit, Tr. Am. Laryng. A. **60**:210, 1938.

venules occurs, and (5) the blood vessels do not become occluded by any specific precipitates.

The gross changes in the nasal mucosa in allergy are probably also secondary to the vascular changes outlined in the preceding paragraph. The intimate relation between the vascular structures of the turbinate body and those of the ethmoid cells and the maxillary sinuses renders involvement of these sinuses almost inevitable if the allergic stimulus is of appreciable duration.

The thinner the lining membrane of a sinus, the more responsive it is to allergic stimuli and the more readily it partakes of the turbinal activity. The mucous membrane of the ethmoid air cells is thinner than that of the other sinuses, but in all other respects, including the presence of glands, it resembles the mucosa of the upper respiratory tract. The air-containing cells vary greatly in number and size, but they are separated from each other by their bony walls, and every space communicates with the nasal fossa, either directly, through its own aperture, or indirectly, through one or more cells. Deficiencies in the bony walls are not infrequent. Each ethmoid cell is small when compared with the maxillary sinus, and each is completely filled with edematous mucosa at an earlier period. The opportunity for extrusion of the mucosa and for the formation of polyps is therefore greater in the ethmoid cells than in the maxilary sinuses and probably accounts for the earlier formation of polyps in the ethmoid region.

Once the polypoid changes in the ethmoid cells are well established, activity may appear in several secondary areas. The ethmoid cells commonly drain into grooves arranged in parallel lines along the upper parts of the lateral nasal wall.[4] These grooves on each side, consist of the hiatus semilunaris and the bullar ostium, in the middle meatus; the posterior groove, in the superior meatus, and the postreme groove in the supreme meatus. While in one person a groove may accommodate the ostiums of several cells, in other persons it may represent a wide space for the drainage of a single cavity or cell. The ostiums of cells may sometimes be situated outside the normal grooves. The presence of these grooves explains in part the facility with which secondary polypoid formations occur after extrusion of edematous mucosa from the ethmoid cells. Eventually a series of pedunculated polyps may be attached along one or more of the grooves.

The extrusion of polyps into the superior meatus leads to abnormal contact and pressure in important olfactory areas, and where the polyps have become large they have been suspected of inducing changes in pressure in the region of the sphenopalatine ganglion. Such abnormal contacts are considered important in the precipitation of some attacks

4. Van Alyea, O. E.: Nasal Sinuses: An Anatomic and Clinical Consideration, Baltimore, Williams & Wilkins Company, 1942.

of intrinsic asthma. In most of these instances, the tissue changes in the ethmoid cells are more important than the changes in the maxillary sinuses, because allergic edema and extrusion of polyps occur earlier in the ethmoid cells than in the maxillary sinuses.

Allergic tissue changes in the ethmoid cells have profound effects on the course of bronchial asthma, especially when they have become advanced and irreversible. Pressure may induce intrinsic asthma, and reduced nasal channels, especially in the presence of polyposis, may cause mouth breathing; air-borne allergens can then reach the lower respiratory tract directly and without filtration in the nasal chambers.

When infection of allergic ethmoidal tissue occurs, a vicious train of events follows. This tissue cannot combat infection with the same efficiency as can nonallergic tissue. The impaired response to acute infection facilitates progress to a chronic status, and chronic infection becomes established. Bacterial sensitization is then possible because of the chronic focus of infection in the ethmoid cells.

Roentgenographic examination frequently indicates very early allergic changes in the mucosa of the ethmoid cells. When minimal changes appear in the absence of purulent secretion in the usual areas of drainage, allergy is probably the etiologic factor. Later, a characteristic absorption of the thin, bony walls of the cells and a typical rarefaction of bone become of diagnostic significance. Condensation of bone is the rule in the presence of infection of the cells; and later in the course of infection, when chronicity is established, there may also be absorption. Even in chronic infection, however, the remaining areas of condensation are pronounced, and the over-all picture differs from that obtained in allergic involvement. When both allergy and infection are present, the roentgenographic findings merely indicate extensive involvement of the ethmoid cells; and the importance of each factor cannot be evaluated.

Treatment of allergic involvement of the ethmoid cells becomes necessary not only to prevent progressive tissue changes and eventual chronic infection but also because of the influence of diseased ethmoid cells on the course of bronchial asthma. Only a competent specialist can deal with the underlying factor—allergy. Neither simple nor radical surgical procedures should be considered prior to complete, systematic cutaneous tests and sincere attempts at desensitization. The local and oral use of vasoconstrictors is justified during the course of the investigation for allergy because of the temporary relief afforded the patient and also because, in some instances, such drugs may impede further changes in the tissues.

Only after it has become evident that treatment of allergy alone is unable to control, or to produce regression in, the tissue changes should surgical measures be attempted. In general, these should be

limited to the most conservative of rhinologic procedures. Removal of polyps, cauterization of polyp-bearing areas and possibly removal of the middle turbinate bone are justifiable procedures, but only if active measures are continued in an attempt to desensitize the patient or to eliminate the offending allergens.

When treatment of allergy fails and conservative rhinologic procedures are obviously inadequate, radical ethmoid exenteration is almost imperative. Such a step is justified only when extreme, irreversible tissue changes have occurred or when chronic infection has complicated the allergic reaction. Once surgical treatment has been attempted, effort should be made to eliminate every cell and to secure smooth surfaces in the area of operation. Irregular surfaces and residual cells serve to perpetuate the formation of edematous tissue and, consequently, of polyposis. Moreover, no matter how thorough surgical exenteration may be, polypoid excrescences will continue to form in the area of operation if the underlying allergy is not controlled.

Wherever possible, allergic involvement of the ethmoid cells should be managed by treatment of allergy alone. Obviously, such measures are most effective when instituted early, before extensive abnormalities have appeared in the soft tissues. Rhinologic procedures, including the most radical surgical measures, have been of no lasting value in the absence of careful investigation and treatment of allergy. Unless determined efforts are made to control the underlying allergy throughout the operative and postoperative periods, and for a long time thereafter, the results of surgical intervention will be disappointing.

326 South Nineteenth Street.

ANESTHESIOLOGY AND OTOLARYNGOLOGY

SAMUEL ROCHBERG, M.D.
BALTIMORE

THE ANESTHESIOLOGIST and the otolaryngologist encounter many mutual problems. They observe many ties and much overlapping in their specialties. To achieve good results, they must understand each other's aims before, during and after every surgical procedure.

They possess something else in common—in institutional life they are frequently relegated to the back seat and assigned the most inexperienced members of the house staff. There is nothing that makes them shudder more than to see a new intern performing tonsillectomy on a patient while someone with a sheepskin in one hand is administering the anesthetic with the other. I am certain that most of my colleagues have discovered, in many an instance, that anesthetizing a patient for tonsillectomy is more difficult and exacting than anesthetizing one for lobectomy or resection of the bowel.

Theoretically, the patient should be admitted the day before operation so that he may become acclimated to the atmosphere of the hospital and properly prepared for surgical treatment. However, the critical shortage of beds has forced many institutions to admit patients for minor surgical operations on the morning on which these operative procedures are to be performed. Breakast should be withheld, and it is imperative that the persons responsible for the patient be instructed to keep food away from him. Too many mothers, feeling sorry for their children, give them a "little" breakfast. Vomiting and aspirating the vomitus during the induction of anesthesia or postoperatively in the reactive period form the background of many a surgical tragedy.

From sixty to ninety minutes prior to surgical treatment the patient should be given either an opiate or a barbituric acid derivative in appropriate dosage and either atropine or scopolamine. A morphine salt, a codeine salt, "pantopon" (a mixture of hydrochlorides of opium alkaloids), dihydromorphinone hydrochloride and meperidine hydrochloride ("demerol hydrochloride") are frequently used. Patients who show an idiosyncrasy to morphine will frequently tolerate one of the

From the Department of Anesthesia, Sinai Hospital.

Presented before the Section on Otolaryngology of the Baltimore City Medical Society, Jan. 7, 1947.

synthetic products, "pantopon," dihydromorphinone hydrochloride or meperidine hydrochloride. The short-acting barbiturates, such as pentobarbital sodium and "seconal sodium," because of the rapidity of their action, are preferable to the longer-acting barbiturates. Morphine and allied drugs will relieve pain, but moderate doses of the barbiturates will not. Proprer premedication, in addition to relieving the patient's pain or apprehension or both, will reduce the amount of anesthetic required.

Scopolamine and atropine diminsh or abolish salivary secretion. Mucus can interfere with the airway by initiating laryngospasm, which not only makes the induction and maintenance of anesthesia difficult but interferes with the proper oxygenation of the patient. Furthermore, various degrees of atelectasis can be produced by the aspiration of mucus.

Atropine and scopolamine directly stimulate metabolism and therefore counteract the depression of the respiratory center produced by the sedative drugs. In addition, they depress the activity of the vagus nerve, thereby helping to protect against cardiac irregularities and laryngospasm. Scopolamine will also produce euphoria or amnesia, and that is advantageous in the proper preparation of the patient.

Should derivatives of belladonna be administered to children? This controversy has raged for some time. Anesthesiologists feel that these drugs should be used in children. Appropriate doses will not, they are certain, produce belladonna poisoning, and will certainly diminish salivary secretion. Because of the high metabolic activity of children, dangerous doses would be necessary in some instances to abolish salivary activity. However, in many cases just the diminution of the amount of mucus will be helpful.

It requires one to one and a half hours for the drugs used as premedicants to exert their maximum effect when administered subcutaneously. When given intramuscularly, they become effective within fifteen to twenty minutes. Only five minutes is necessary for the desired effect when the intravenous route is used. This avenue is helpful when the premedication has been erroneously omitted or has lost its effect. With intravenous administration, however, smaller doses should be used. The barbiturates can be given rectally in both children and adults.

Many surgeons and anesthesiologists prefer one drug or combination of drugs to others and have used them with great success. However, one must always remember that the dosage varies with the patient, the operation and the anesthesia. In choosing the dosage, the patient's age, size and occupation must be borne in mind; fever, pain, hyperthyroidism, pregnancy, alcoholism (both chronic and social), emotional excitement—all call for increased dosage; cachectic and debilitating

diseases, anemia, hemorrhage, shock, cardiorenal disease and hypothyroidism all necessitate smaller doses. When the patient is to be operated on under local anesthesia, a barbiturate should be given in addition to an opiate, not only for its hypnotic effect but also for its counteraction of any possible reaction evoked by the local anesthetic agent. If the procedure is a long one, and the premedication is wearing off, one can make the patient more comfortable by further administration of the opiate or the barbiturate or both.

TABLE 1.—*Morphine and Scopolamine or Atropine*

Age	Weight, Lb.	Morphine Sulfate, Grain, Mg.	Scopolamine Hydrobromide, Grain, Mg.	Atropine Sulfate, Grain, Mg.
Up to 2 mo.	7-10	1/480 (0.13 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
2-3 mo.	10-12	1/360 (0.18 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
3-4 mo.	12-14	1/240 (0.27 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
4-7 mo.	14-16	1/144 (0.45 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
7-11 mo.	16-19	1/120 (0.54 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
11-18 mo.	19-24	1/108 (0.60 mg.)	1/600 (0.10 mg.)	1/400 (0.16 mg.)
18 mo.-2 yr.	24-27	1/72 (0.90 mg.)	1/450 (0.14 mg.)	1/300 (0.22 mg.)
2-3 yr.	27-30	1/60 (1.0 mg.)	1/450 (0.14 mg.)	1/300 (0.22 mg.)
3-5 yr.	30-40	1/48 (1.35 mg.)	1/450 (0.14 mg.)	1/300 (0.22 mg.)
6-8 yr.	40-55	1/36 (1.80 mg.)	1/300 (0.22 mg.)	1/200 (0.30 mg.)
8-10 yr.	55-65	1/24 (2.70 mg.)	1/300 (0.22 mg.)	1/200 (0.30 mg.)
10-12 yr.	65-80	1/18 (3.60 mg.)	1/200 (0.30 mg.)	1/100 (0.65 mg.)
12-14 yr.	80-90	1/12 (5.40 mg.)	1/150 (0.43 mg.)	1/75 (0.86 mg.)
Adult	Over 90	1/8-1/4 8.10-16 mg.)	1/150-1/100 (0.43-0.65 mg.)	1/75 (0.86 mg.)

TABLE 2.—*Meperidine Hydrochloride ("Demerol Hydrochloride")*

Age, Years	Cc.	Mg.
1-2	¼	13
3-4	⅓	18
5-6	½	25
7-8	¾	37
9-12	1	50
13	1½	75
Adult	2	100

Tables 1 to 4, prepared by Leigh and Belton,[1] of Montreal, Canada, and based on a great deal of experience, may be helpful.

Many anesthetic agents and various technics of administration have been used in the field of otolaryngology. Except for rare cases, anesthesiologists do not feel that any one specific drug or technic is indicated for a certain surgical procedure. The case is a better risk when surgeon and anesthesiologist are using familiar methods, provided those methods are physiologically sound.

1. Leigh, M. D., and Belton, M. K.: Premedication in Infants and Children. Anesthesiology **7**:611-615 (Dec.) 1946.

Local and regional anesthesia have been employed with great success in otolaryngologic practice. The drug used should possess certain features: It should not be irritating to the tissues, nor should it damage nerve structure; the systemic toxicity produced should be low; the concentration needed for effective anesthesia should be low; the duration of action must be sufficiently long to permit the carrying out of the surgical procedure; the time required for the onset of anesthesia should be short, and as an ideal local anesthetic the drug should be effective when injected or when applied topically. Some of the drugs which meet the foregoing requirements and enjoy wide clinical usage are cocaine hydrochloride, procaine hydrochloride ("novocaine"), butacaine sulfate ("butyn sulfate"), "larocaine hydrochloride," "metycaine hydrochloride," tetracaine hydrochloride ("pontocaine hydrochloride") and dibucaine hydrochloride ("nupercaine hydrochloride").

TABLE 3.—*Pentobarbital Sodium*

Age, Years	Grains (Mg.)
1-3	¼ (16 mg.)
3-7	½ (32 mg.)
7-12	1 (64.5 mg.)
Over 12	1½ (96.5 mg.)

TABLE 4.—*"Seconal Sodium"*

Age	Grains (Mg.)
3-6 mo.	¼ to ⅜ (8-24 mg.)
6-36 mo.	⅜ to ½ (24-32 mg.)
3-8 yr.	¾ (48.5 mg.)
8-15 yr.	¾ to 1½ (48.5-96.5 mg.)

The action of the local anesthetic agents can be prolonged by the addition of such vasoconstrictors as epinephrine hydrochloride or "cobefrin" (3, 4-dihydroxy-norephedrine). When the blood vessels at the site of injection become constricted, the absorption of the anesthetic agent is delayed; thus its effectiveness is increased, and the body is allowed more time in which to detoxify the drug. This is important in cases in which sensitivity is present. Cocaine will itself produce vasoconstriction, thereby delaying its own absorption.

The inherent danger of the use of the agents producing local anesthesia lies in individual susceptibility or sensitivity. The manifestation of such sensitivity is commonly known as a cocaine or a procaine reaction. It may be mild and long in appearing or swift and tragic. Headache, vertigo, restlessness, tremors and convulsions may be seen, with death resulting from respiratory failure. The proper

and immediate treatment should be to inject intravenously "pentothal sodium" and to administer oxygen by positive pressure from an anesthetic machine. The barbiturates are almost specific in the antagonism they exert toward procaine sensitivity, and therefore they should be used prophylactically in the preparation of the patient.

The agents producing local anesthesia may also act adversely on the circulatory system, producing various degrees of collapse and shock or sudden cardiac standstill. Treatment consists in an intravenous injection of a barbiturate and administration of oxygen and a sympathomimetic agent, such as ephedrine hydrochloride or sulfate or phenylephrine hydrochloride ("neo-synephrin hydrochloride").

Some of the reactions seen with local anesthesia are due to the epinephrine in the anesthetic solution.

Because of the high incidence of accidents occurring during local anesthesia, a special committee of the American Medical Association made the following recommedations: (1) Cocaine hydrochloride and butacaine sulfate should be restricted to surface applications; (2) the total amounts of the cocaine salt used should not exceed 0.1 Gm.; (3) procaine hydrochloride may be injected, but its concentration should be limited to 1.0 per cent; (4) precautions should be taken not to confuse cocaine hydrochloride and procaine hydrochloride, as a number of fatalities have resulted from this error.

I have tried to stress individual susceptibility to the drugs producing local anesthesia, because too often minute quantities will produce severe reactions. Furthermore, some of one's ideas concerning procaine and associated drugs have received a jolt in the past two years. The British and the Canadians have been injecting procaine hydrochloride intravenously for the relief of pain in severe burns and for postoperative pain. In this country intravenous use of this drug has saved lives by dramatically correcting cardiac irregularities in patients undergoing surgical treatment for pulmonary and cardiac conditions; Frederick Allen, of New York, reported that he had used it successfully in obstetric practice without observing any untoward result in mother or infant.

In an effort to avoid accidents one should question each patient closely as to previous experience with local anesthesia and make a cutaneous or a mucosal test of the drug to be used whenever possible. A mucosal test is made by applying a small quantity of the drug to the mucous membrane; if no systemic reaction has appeared within ten minutes, that agent is considered relatively innocuous in that patient.

Proper local anesthesia, obtained by either a topical application or a regional nerve block or a combination of both, will permit many procedures to be done on the head or the neck of the well premedicated patient. To become proficient in nerve blocking, one should be well

acquainted with the anatomy of the region in which nerve block is to be achieved and should not be disheartened by early failures. Furthermore, the surgeon must realize that his operative time is limited by the duration of the anesthesia, and his patient's comfort may last only as long as the sedation. However, if need be, both anesthetic and sedative can be administered again.

In many instances the operative procedure or the desires of the patient or of the surgeon may warrant general anesthesia. First, the anesthesiologist and the surgeon must ask themselves, "Should this patient be put to sleep?" I can vividly recall a case in which I was involved during my training:

An obese lady in her early thirties was to undergo a pelvic laparotomy for uterine fibroids. Nothing in her history foretold any difficulties relative to anesthesia. Several minutes after the induction I heard gurgling and bubbling noises coming from her mouth. The face mask was removed, and there was fresh blood pouring from her nose and mouth. Suction was begun immediately, the patient being placed in the Trendelenburg position, and the operation was canceled. I soon realized that a nose bleed was the problem; it was controlled by packing, and the patient was returned to her room. She later confessed that she frequently had nosebleeds but had forgotten to mention this minor fact to the house staff. The operation was done forty-eight hours later, with this patient under spinal anesthesia.

I should like to recall another case:

A colleague of mine was called one afternoon to administer a "little pentothal sodium" to a patient who was to undergo incision and drainage of the site of Ludwig's angina (cellulitis of the floor of the mouth). The anesthesiologist requested that a preliminary tracheotomy be done. The request was refused. A few cubic centimeters of "pentothal sodium" was administered, and suddenly the patient stopped breathing. All efforts at resuscitation failed.

When one is dealing with a tumor or an inflammation of the neck or the nasopharynx one must be certain that the airway will be adequate once anesthesia has been established. Pressure, collateral edema or obstructive size of the tumor or the abscess may be producing moderate respiratory distress prior to anesthesia. Too frequently hypoxia and anoxia appear when the patient is asleep unless a proper airway has already been established. This can be done either by preliminary tracheotomy or by nasotracheal intubation under topical anesthesia. A laryngscope with a thin blade and a pair of long curved forceps to direct the tube are essential for intubation. These instruments should be used with great gentleness.

After a suitable airway has been established, light anesthesia, induced with either "pentothal sodium" or any of the gaseous agents, can be employed. If it is a tumor that is being removed, deeper anesthesia will be necessary. If an intraoral abscess is to be opened, anesthesia

light enough to preserve the cough reflex and a steep Trendelenburg position are indicated. The mortality rate in cases of Ludwig's angina runs from 50 to 60 per cent. The necessity for teamwork is obvious.

Of all the anesthetic agents at the command of the anesthesiologists and the surgeon, ether U. S. P. is still the standard and certainly the most popular one. The ease of its administration and the great margin of safety are important factors. All, however, have been disturbed by the screaming of the young patient during induction, and certainly none would think of administering "straight" ether to an adult. Nitrous oxide U. S. P., ethylene or cyclopropane U. S. P. can be used for induction with both children and adults; "pentothal sodium" may be used with patients over 10 years of age. My associates and I have found ethyl chloride and vinyl ether, or "vinethene," administered by the open drop technic, to be suitable for children. Both agents are more potent and less irritating to the olfactory sense and the pulmonary tree than ether. We have also found them useful in short otolaryngologic procedures. However, because of their potency, they must be handled with great care and caution. Vinyl ether, which is an unsaturated ether, has a wider margin of safety than ethyl chloride and therefore is the safer agent.

Ishould like to interject one word of caution. A few weeks ago I was called to anesthetize a child for the suturing of a laceration. Just as I was about to begin, I noticed the youngster's jaws working rapidly. I held out my hand and said, "Let me hold that chewing gum for you, sonny." Thereupon I became the proprietor of the "bubble gum." Children are fond of placing foreign objects in their mouths, particularly candy or chewing gum. This should be remembered prior to anesthesia. During anesthesia one should be careful of any loose teeth or dentures of children or adults. A well fitting denture which one knows is present should not cause any concern.

There are many machines and devices, some complicated and some simple, for the administration of ether for adenotonsillectomy. Essentially, all are designed to pass air or oxygen through ether to the patient's oropharynx. However, it is possible, if the apparatus is set up incorrectly, for liquid ether to be sucked into the patient's mouth. Tragedy can occur before one is aware of what has gone wrong. It is the sole responsibility of the anesthesiologist to check the apparatus before each and every use.

In an effort to keep blood and mucus away from the glottis during the operation, my associates and I have resorted to the effects of gravity that are gained by the Trendelenburg position. This will decrease the danger of aspiration, of blocking of the glottic orifice by accumulated blood, and of laryngospasm in cases in which only a slight amount of blood or mucus will produce abduction of varying degrees of the vocal cords and eventually oxygen lack .

To maintain an adequate airway, various gags and tongue depressors have been used. The Davis gag which is so frequently used can be held by the anesthesiologist. Thus there is no need of a good assistant to hold the loose type of blade. Too often, the loose blade is handed over to someone who has little notion of how to hold the instrument properly. Thereupon, the tongue and blood encroach on the airway, and the surgeon and the anesthesiologist struggle for proper exposure and adequate oxygenation. When the proper-sized blade is attached to the Davis gag, the tip of the blade will fit into the hypoepiglottic sulcus and the tongue will be sufficiently depressed to insure an adequate airway.

A careful check should be kept of the sponges placed in the mouth or the nasopharynx.

As the adenotonsillectomy is nearing completion, anesthesia should be lightened considerably, so that the cough reflex can be elicited to expel some of the foreign matter in the tracheobronchial tree. At the conclusion of the procedure, the patient should be placed on the stretcher in a semilateral position with the head extended and the upper leg flexed. The same position should be used when the patient is transferred to his bed. The tongue will tend to fall forward, and blood and secretions will not collect near the glottis. Furthermore, should the patient cough or vomit, the oral contents will be expelled onto the bed, whence the patient cannot aspirate them. About two years ago an infant was operated on for harelip and cleft palate; after completion of the dressings, the child was placed on its back and its hands were tied so that it would not pick at its bandages. During the period of recovery, the child vomited, aspirated and died before anything could be done. The reason anesthetist and surgeon are so concerned about an active cough reflex, position and aspiration is because of the possibility of atelectasis, bronchopneumonia and pulmonary abscess. Bronchoscopic studies following tonsillectomy have shown that as many as 78 per cent of these patients will have blood in the tracheobronchial tree in spite of the prophylactic measures. Given the organisms found in infected tonsillar crypts, the proper culture medium in the dependent portion of the bronchial tree and lowered resistance, one may well be surprised that the incidence of pulmonary abscess is not higher in these patients.

During the past three years my associates and I have had some interesting experiences relating to anesthesia induced with "pentothal sodium" in adults who were to undergo tonsillectomy. We have not used this drug in children under 10 years of age, because of our belief that in these patients the margin of safety is not great enough. The strength of the solution used ranges from 1.25 to 2.5 per cent. As

soon as the patient is profoundly asleep, the Davis gag is inserted. The operator should not begin until the throat muscles are quiet and the pharyngeal reflex is abolished; otherwise, the stimulation produced may make it difficult to maintain smooth anesthesia. A piece of rubber tubing, connecting the anesthesia machine to the Davis gag, carries equal parts of oxygen and nitrous oxide. This mixture will furnish additional oxygen to the patient and will reduce the amount of "pentothal sodium" needed. For maintenance, "pentothal sodium" is administered intermittently as needed. The patient's color and the diaphragmatic movements are closely observed. At the end of the operation a breathing tube is placed in the mouth to maintain an adequate airway until the pharyngeal reflexes have returned. Between 1.0 and 1.5 Gm. suffices for the average patient. Occasionally 2.0 Gm. has been necessary.

The most troublesome complication has been laryngospasm. Usually this was overcome by temporarily stopping the operation, suctioning all blood and secretions from the throat and administering more "pentothal sodium." Some physicians have been routinely cocainizing the throat just prior to surgical procedure to prevent laryngospasm and to diminish the amount of "pentothal sodium" required. We have felt that obtunding the patient's reflexes would increase the likelihood of postoperative pulmonary complications, and, therefore, we have refrained from this practice. However, in several cases in which the laryngospasm was severe enough to produce hypoxia we have applied sponges medicated with 2 per cent tetracaine hydrochloride to the tissues surrounding the tracheal orifice. This procedure has been of some aid. In several cases the spasm was ameliorated by small divided doses of curare. If these maneuvers should fail, a nasotracheal tube should be inserted and the trachea packed off so that foreign matter will not run along the tube and into the trachea. When one is faced with a heavy, thick, short-necked patient, one can insert the tube before the operation is begun and thereby insure a good airway and smooth anesthesia. The tube should not be removed until the patient is almost awake.

The average patient reacts and becomes rational in about thirty minutes. Caffeine and sodium benzoate injection U. S. P. (0.5 Gm. [7.5 grains]) may be administered intramuscularly if the patient is sleeping too long.

The endotracheal tube can be and should be used more frequently for tonsillectomy. McCarthy [2] reported 1,550 cases in which tonsillectomy was performed on adults anesthetized by endotracheal administration of nitrous oxide. Whenever the surgeon and the anesthetist find that they cannot correct persistent hypoxia, intubation should be performed. One should remember that cerebral changes produced by inadequate oxygenation can never be corrected.

2. McCarthy, K. C.: Endotracheal Nitrous Oxide Anesthesia for Tonsillectomy, Anesthesiology **1**:216-222 (Sept.) 1940.

The endotracheal tube should also be used in otolaryngologic procedures in which the anesthesiologist is "draped out of the field," or in which he has no control of the airway once surgical operation has begun, or in which there is likelihood of aspiration of foreign or infected matter. Depending on the site of the operation, the orotracheal or the nasotracheal technic may be followed. A tube with an inflatable cuff should be used whenever one wishes to seal off the tracheobronchial tree and prevent aspiration. At the conclusion of the operation, all secretions, blood and pus are suctioned off; the cuff is then deflated and the tube removed. Whenever indicated, the tube should be allowed to remain until the patient is fully awake. During the war this proved to be a life-saving measure in personnel with severe facial, oral and cervical injuries. Many a technic or variation thereof has been advanced as the ideal method of securing anesthesia for extensive laryngeal operations. I believe that the ideal setup for laryngeal operations is a cooperative surgeon, a competent anesthesiologist and a cuffed endotracheal tube.

The drug that has fascinated many anesthesiologists and surgeons is curare. Curare, which is a derivative of the plant Strychnos, has gained widespread usage in general surgical practice because of its ability to relax striated muscle. Prostigmine is the physiologic antidote. Curare has been found to be valuable in endoscopic practice. There are occasions when, in spite of premedication and good topical anesthesia, enough relaxation cannot be obtained for bronchoscopic or esophagoscopic procedures. At such times a small dose of curare (20 mg. for a child and 50 to 60 mg. for an adult) given intravenously may produce the extra amount of relaxation needed. If required, additional curare may be administered in very small doses. However, my associates and I feel that curare, because of its potency, should be used only in institutions and by someone familiar with the drug and with the technic of controlled breathing.

In conclusion, I should like to reiterate the necessity for greater cooperation and understanding between otolaryngologists and anesthesiologists. Then they will achieve better anesthesia and finer surgical results, with fewer complications.

EFFECT OF DIFFERENTIAL MOBILITY OF THE WINDOWS OF THE COCHLEA ON THE MECHANISM OF HEARING

JOSEPH A. SULLIVAN, M.B.

Associate Professor, Department of Otolaryngology, the University of Toronto
Head of the Department of Otolaryngology, St. Michael's Hospital

AND

W. E. HODGES, M.A.Sc.

TORONTO, CANADA

IN ORDER to explain many of the unanswered questions pertaining to the functioning of the mechanism of the ear as it pertains to practical otologic diagnosis, the following hypothesis has been propounded. The basis for it was initially presented by von Békésy [1] in his original work on the reception of sound by bone conduction.

INITIAL CONCEPT

First, one may look on the cochlea as being made up of two ideally symmetric cavities, separated by a uniformly flexible basilar membrane except for an analogous helicotrema and terminated in two similar membranous windows having the same elastic properties. This concept is diagrammatically shown in figure 1*A*, which depicts a cross section. Now, if the bony side walls of such a cavity were made to vibrate by a source of sound applied to the skull containing such a cochlea, it should be evident that the side walls would be alternately compressed and released; that is, they would move in and out between the solid and the broken lines (diagrammatically this movement has been exaggerated for sake of clarity). Such motion would produce corresponding compression and expansion of the fluid in each compartment of the cochlea, with the result that the liquid pressures in each compartment would remain equal. This means that the same normal force is exerted on all analogous sides of each compartment. In the case of the basilar membrane these forces are equal and opposing one another; therefore there is no resultant displacement of the membrane. However, in the case of the elastic windows these forces are acting in

This research was made possible by a grant from the W. H. Wright Foundation.

From the Departments of Physics and Otolaryngology, the University of Toronto.

1. von Békésy, G.: Zur Theorie des Hörens bei der Schallaufnahme durch Knochenleitung, Ann. d. Physik **13**:111, 1932.

the same direction, and, as the windows are extremely flexible as compared to the bony side walls, each is displaced outwardly to the same degree.

In the event that the membrane of one window of such a cochlea, say the upper, is less elastic than that of the other, it should be apparent that a greater displacement of the more elastic window will occur for the same applied force. When the side walls of the compartments containing such windows are stimulated as before, a momentary increase in the pressure of the liquid of the upper compartment relative to the lower will result, since the compartments no longer have a symmetry of elasticity. However, when a difference of pressure exists in such compartments, there is an automatic tendency to bring the acting forces to equilibrium at any instant; this tendency actually involves the simultaneous motion not only of the two windows (the outward motion

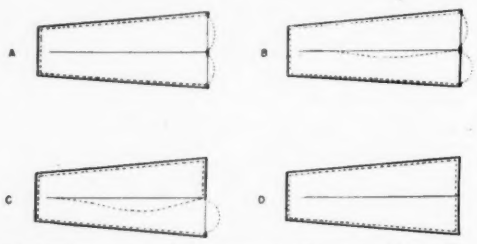


Fig. 1.—Illustrations of a simple concept of the cochlea. The solid lines represent the outlines of the scalae during the steady state; the broken lines represent those during the excited state.

of which merely tends to decrease the pressure of the liquid in the compartments) but also of the mobile basilar membrane. In this particular example the lesser of the two forces acting on the basilar membrane would be on the under side; hence the membrane would be displaced downward in order to satisfy these conditions of equilibrium. The resultant displacement of the membrane, corresponding as before to the maximum positive excitation of the cochlea would be as shown in figure 1*B*.

The third possibility is the complete blocking of, say, the upper window by bony structure. In accord with reasoning similar to that used in the preceding examples, it is obvious that the result would be a maximum displacement of the basilar membrane and of the lower window, as shown in figure 1*C*. If the cochlea were completely encased in bony structure, as in figure 1*D*, the resultant stimulation of the basilar membrane would be the same as for the concept of the cochlea in figure 1*A*.

The reader should note at this point that in the presentation of this work only the crest of the exciting cycle is considered and that the frequency of the exciting source is such in each example as to produce a maximum displacement of the basilar membrane at the point shown, in accordance with the resonance theory of hearing.

HUMAN ACTUAL COCHLEA

The consideration of the human cochlea (fig. 2) must account for the following factors: (1) the added effect of the attached semicircular canals to the upper compartment, or scala vestibuli, and (2) the difference between the oval and the round window.

According to a reasoning similar to that applied to the simple cochlea, if the human cochlea were excited in a fashion like that previously described, the only modification of the results would be one due to the additional fluid attachment of the labyrinth; this would

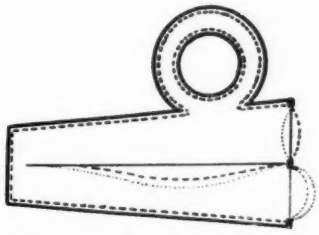


Fig. 2.—Diagrammatic representation of the human cochlea. Outlines of the scalae during the steady state are represented by the solid lines; in the excited state, motion due to air conduction is shown by the dotted line, and that due to bone conduction, by the broken line.

create a greater pressure of fluid in the scala vestibuli than in the scala tympani. The effect would be that of an added downward displacement of the basilar membrane, analogous to its movement in the simple cochlea previously considered in this paper. Why it would take place is seen when the relative elasticity of the membranes of the round and oval windows with respect to the basilar membrane is considered. Until this point the basilar membrane has been considered as being a separating medium only, with perfect freedom of motion or elasticity. Practically, this state is an impossibility. Since the dynamics of the inner ear have not been determined, it would appear most likely that the motion of the basilar membrane would be combined with that of the round window in order to assure that they both have the same elasticity or freedom of motion. An accepted fact, however, is that the elasticity of the round window is greater than that of the oval window. This may be appreciated by observation of the differ-

ence in shape and the attachment of the stapes to the oval window. That is to say, the mobility of the windows differs. It is this differential of mobility between the oval and the round window which is the significant factor in the determination of the magnitude of the resultant stimulation by the motion of the rods of Corti on the basilar membrane of the neural elements leading to the brain.

So far only the excitation of the cochlea by the bony side walls encasing the same (bone conduction) has been considered. To complete the picture, a consideration of the effect of excitation of the cochlea by the ossicular-tympanic pathway (air conduction) must be included. By convention, the positive crest of a sound wave acting on the ear drum membrane forces the stapes and the membrane of the oval window inward. Since the endolymph and the perilymph are incompressible, and the bony side walls of the cochlea are immobile under such excitation, the inward motion of the oval window can be compensated for only by the outward motion of the round window and the downward displacement of the basilar membrane, as shown in figure 2. By comparison of the relative motion of the window for bone conduction (broken lines) with that for air conduction (dotted lines) the difference in the magnitude of the stimulation can be seen in terms of the displacement of the basilar membrane. Therefore, it should be apparent that, the greater the differential between the position of the windows at rest (solid lines) and their maximum excursion (positive or negative) when excited, the greater is the stimulation of the basilar membrane. From this conclusion it would appear that, for the normally functioning ear, in order that the same apparent stimulation would result when the inner ear was excited by bone conduction as when it was excited by air conduction, a loss of fluid pressure by the oval window would have to be prevented by the reflex action of the intra-aural muscles, holding the stapes relatively fixed and thereby approaching the condition shown in figure 1*C*, as otherwise as great a stimulation by bone-conducted sound as by air-conducted sound would be impossible.

CLINICAL VERIFICATION

The application of this hypothesis to the impaired ear readily explains many of the observed phenomena. In the case of stapedial ankylosis, in which there is a natural blocking of the oval window, lowering of the threshold of bone conduction can be expected, as the differential mobility of the two windows has been increased to a practical maximum. This has often been observed in the impaired ear and produced artificially by fixation of the stapes.

In the case of the normal ear, if a sufficient difference in pressure is obtained between the middle and the outer ear, it is possible effec-

tively to reduce the threshold of hearing not only by bone conduction but also by air conduction, to a great degree. That is, when increased pressure of the middle ear from either liquid or air, as in altitude changes, effectively blocks or prevents the motion of both windows, the same phenomenon results as has been often observed when the middle ear is occupied with scar tissue.

In a radical mastoidectomy, for example, the formation of scar tissue on the internal wall of the middle ear inevitably reduces the

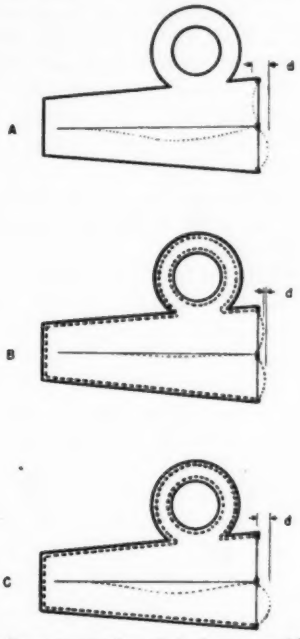


Fig. 3.—Diagrammatic representation of the human cochlea, showing hypothetic responses to air conduction and bone conduction under certain conditions. The solid lines show outlines in the steady state; the dotted lines, those during the excited state due to air conduction, and the broken lines, those during the excited state due to bone conduction.

threshold of hearing. In view of the foregoing explanations, the reason should be evident. It could be added, however, that a considerable increase in the ability to hear can be made by the simple addition of an artificial drum in the external auditory meatus, with an attached prosthesis touching either window.

With reference to the reasoning given for excitation of the cochlea by air conduction, it is possible to explain some forms of the paradoxic

situation encountered in which the reception by air conduction is better than that by bone conduction in terms of the average normal ear. Should the membrane of the round window be made slightly immobile, owing to thickening or foreign obstruction, for example, then for air conduction the relative motions of the membranes would be as shown in figure 3*A*, with a differential between the windows (*d*), while the motion for excitation by bone conduction would be as shown in figure 3*B*, where the differential is seen to be practically nonexistent for an outward motion of the oval window and approximately one-half that for air conduction, figure 3*C*, if the stapes is held fixed at its point of rest. Thus a possible explanation of the phenomenon is revealed.

From the standpoint of the selection of cases most suitable for the fenestration procedure, it is well to consider that the filling in of the niche of the round window with scar tissue or a bony structure due to malignant otosclerosis would result in apparent perceptive deafness, a deafness not necessarily present unless such a condition affected the nerve and the functioning parts of the inner ear from atrophy of disuse over an extended period.

The realization that an apparent perceptive deafness may result from the immobility of the windows of the inner ear opens a new field of otologic diagnosis.

CONCLUSION

The presentation of this hypothesis and its practical illustrations is made in the interest of otology as a further aid to the diagnostician and also to the research worker in understanding how the mechanism of the ear functions.

174 St. George Street (5).

LOCAL STREPTOMYCIN THERAPY FOR SUPPURATIVE OTITIS

Bacteriologic and Clinical Observations

H. WILLIAM HARRIS, M.D.
LAWRENCE KILHAM, M.D.
AND
MAXWELL FINLAND, M.D.
BOSTON

CHRONIC suppurative otitis media is a fairly common and sometimes serious disease. In addition to the persistent discharge, which is often foul smelling and disagreeable, there may be serious complications and sequelae, including deafness, meningitis and abscess of the brain. The known treatment of chronic otitis media is far from satisfactory. Conservative types of therapy involve cleansing and drying of the middle ear and instillation of various antiseptics, sulfonamide drugs or penicillin.[1] These are successful in some instances, but many patients are benefited only by appropriate surgical measures.

Collins and Hughes [1d] studied the bacterial flora of 26 ears of 23 previously untreated patients with chronic otitis media and observed that gram-negative bacilli were more frequently present than gram-positive cocci. Repeated cultures of flora from the middle ear cavities of certain patients treated locally with penicillin revealed a complete change from the original, predominantly gram-positive organisms, sensitive to penicillin, to gram-negative bacilli, resistant to penicillin. They concluded that "the presence of the secondary organisms such as the coliform bacteria, Proteus vulgaris and diphtheroids was undoubtedly one of the complicating factors limiting the successful treatment of chronic suppurative otitis media with penicillin."

This study was aided by a grant from the United States Public Health Service.

From the Thorndike Memorial Laboratory, Second and Fourth Medical Services (Harvard); the Mallory Institute of Pathology, Boston City Hospital, and the Department of Medicine, Harvard Medical School.

1. (*a*) Leech, M. P.; Bloom, W. A.; Coffman, D. L., and Shaw, W. J.: Treatment of Chronic Purulent Otitis Media with Sulfathiazole Crystals, J. Missouri M. A. **40**:292 (Sept.) 1943. (*b*) Heatley, C. A.: Chronic Diseases of the Nose, Throat and Ear, M. Clin. North America **28**:330-338 (March) 1944. (*c*) Banham, T. M.: Conservative Treatment of Chronic Suppurative Otitis Media in Adults, J. Laryng. & Otol. **59**:117-135 (April) 1944. (*d*) Collins, E. G., and Hughes, K. E. A.: Treatment of Chronic Suppurative Otitis Media by the Local Application of Penicillin and Other Drugs, ibid. **59**:81-95 (March) 1944. (*e*) Williams, H. J.: Chronic Suppurative Otitis Media, Pennsylvania M. J. **48**:1159-1161 (Aug.) 1945.

Bacteriologic studies of the aural discharge in cases of otitis externa also reveal the prominent role of gram-negative bacilli in these infections. Pseudomonas aeruginosa was the predominant organism in 45 of 100 consecutive cases reported by Salvin and Lewis.[2] In another study,[3] of 72 ears, the same organism was found in 67 per cent; other gram-negative bacilli were cultured in 17 per cent. Such organisms were also noted in other cases of otitis externa, and the failure of local and parenteral penicillin therapy has been ascribed to their presence in the exudate.[4]

It thus appears that both otitis media and otitis externa are frequently caused by, or at least are associated with, gram-negative bacilli which are not susceptible to penicillin and which are affected little, if at all, by sulfonamide drugs. These organisms are sensitive to streptomycin, however, and a clinical trial of this antibiotic in cases of otitis with susceptible organisms seemed warranted.

One of the most important factors which limit the effectiveness of streptomycin against many infections is the rapid development of resistance to the antibiotic by the infecting organisms. In vitro the production of strains resistant to antibacterial agents is best accomplished by repeated subcultures of the organisms in mediums containing increasing, but sublethal, concentrations of the agents. It is also possible in some instances to produce resistant strains in vivo by treating certain experimental infections with subeffective amounts of these agents. It is therefore generally assumed that the development of resistant strains during therapy could be avoided by the use of doses large enough to maintain concentrations of the antibacterial agents well in excess of the minimum amount required to inhibit the growth of the organism.

It is important to determine the validity of this assumption, both from the point of view of practical therapeutics and because of the light such knowledge might shed on the mechanism of the development of resistance by bacteria. In systemic therapy one cannot be certain of maintaining adequate concentrations at the site of the infection. That should be possible, however, with topical applications in cases of certain types of accessible focal infections. Local streptomycin therapy for suppurative infections of the ear caused by strains of bacteria sensitive to that agent would seem to offer suitable conditions for such a test. This method of treatment was therefore chosen, and

2. Salvin, S. B., and Lewis, M. L.: External Otitis, with Additional Studies on the Genus Pseudomonas, J. Bact. **51**:495-506 (April) 1946.

3. Syverton, J. T.; Hess, W. R., and Krafchuk, J.: Otitis Externa: Clinical Observations and Microbiologic Flora, Arch. Otolaryng. **43**:213-225 (March) 1946.

4. Senturia, B. H.: Treatment of External Otitis: Local Sulfonamide Therapy, Laryngoscope **54**:277-280 (June) 1944; Penicillin Therapy in External Otitis, Ann. Otol., Rhin. & Laryng. **55**:90-107 (March) 1946.

a limited study was undertaken to determine its effect on the flora and on the clinical course of such infections. The results of bacteriologic and clinical observations made on 27 suppurating ears in 18 patients are the subject of this report.

MATERIALS AND METHODS

Selection of Patients.[5]—The 18 patients selected for local streptomycin therapy had persistent aural discharges which on culture yielded organisms sensitive to streptomycin. Six of the patients were treated in the hospital and the rest as outpatients. The infections involved one ear in each of 9 patients and both ears in the rest: a total of 27 suppurating ears. For convenience, data on these ears were tabulated in three groups, as follows (tables 1 and 2):

Group 1 (ears 1-5, in 5 patients): The patients were admitted to the aural service of the Boston City Hospital for acute suppurative otitis media. In each of these patients fever and pain subsided soon after admission to the hospital, but a profuse, foul-smelling discharge persisted from one to six weeks, in spite of continuous treatment with local and parenteral administration of penicillin, oral administration of sulfadiazine and irrigation with hydrogen peroxide. One of these patients also had chronic otitis media of the other ear; it is included as ear 6 in group 2.

Group 2 (ears 6-24, in 12 patients): Purulent discharge from these ears had persisted or recurred frequently over periods of from one to twenty-five years. Otoscopic examination in each instance revealed perforation or absence of the tympanic membrane and a purulent discharge from the middle ear. Mastoidectomy had been done on 5 patients, and roentgenograms indicated changes consistent with chronic mastoiditis in 5 others.

Group 3 (ears 25-27, in 2 patients): The patients had chronic suppurative otitis externa. In 1 of them both ears had drained profusely for two months, and in the other the left ear had had slight but persistent drainage for sixteen months. Otoscopic examination in each case revealed a red and inflamed wall of the external auditory canal, but a normal and intact tympanic membrane.

Bacteriologic Studies.—Cultures of the aural discharge were made on one or more occasions before the streptomycin treatment was begun and were repeated at intervals during and after the course of therapy. The cultures were made by inserting a sterile cotton swab deep into the external auditory canal and streaking the tip of the swab on the surface of nutrient agar containing 10 per cent horse blood. The tip of the swab was then placed in a tube of nutrient broth, from which subcultures were made on other blood agar plates. Individual colony types were subcultured on fresh blood agar plates, and the various strains were then identified from pure cultures on the basis of their morphologic, cultural and biochemical characteristics. Tests for the sensitivity of these strains to streptomycin[6] were carried out on broth cultures by a serial dilution method, the details of which have been given elsewhere.[7]

5. Drs. Solomon Steinman, Sidney Wilker, Irving F. Gregory, Alfred Blouin, Chester Goodnow, Raymond Conway and Daniel F. Shea, all of the Aural Service of the Boston City Hospital, made follow-up observations on these patients.

6. Miss Marion E. Lamb, of the Mallory Institute of Pathology, assisted in the identification and classification of the various strains. Miss Clare Wilcox made the tests for sensitivity.

7. Harris, H. W.; Murray, R.; Paine, T. F.; Kilham, L., and Finland, M.: Streptomycin Treatment of Urinary Tract Infections with Special Reference to the Use of Alkali, Am. J. Med. **2**:229-250 (March) 1947.

TABLE 1.—*Summary of Bacteriologic Observations and Clinical Responses in Cases of Suppurative Otitis Treated with Topical Applications of Streptomycin Solutions*

Ear		Before Streptomycin Therapy			Local Streptomycin			During Streptomycin Therapy				Duration of Follow-up Observation
No.	Side	Duration of Drainage	Organisms	M.I.C.*	Units per Cc.	Cc. per Day	Days	Drainage	Organisms	M.I.C.*	Results and Comment	
								Group 1				
1	Left	6 wk.	Proteus vulgaris	50	10,000	4	14	Stopped in 9 days	P. vulgaris Staph. albus	50 12.5	Cultures sterile after 3 days; ear remained dry	6 mo.
2	Left	4 wk.	Pseudomonas aeruginosa	50	5,000	6	12	Stopped in 4 days	None	....	Ear remained dry	2½ mo.
3	Left	2 wk.	Ps. aeruginosa P. vulgaris	200	5,000	6	15	Stopped in 8 days	Ps. aeruginosa P. vulgaris	>50,000 >50,000	Cultures sterile after 12 days; ear remained dry	3 mo.
4	Right	1 wk.	P. vulgaris	100	10,000 P 100†	8	9	Temporarily reduced	P. vulgaris	100	Acute mastoiditis eighth day; mastoidectomy ninth day; second course of streptomycin begun 18 days later; resistance developed next day; no clinical improvement	3 mo.
		4 wk.	P. vulgaris	100	10,000	8	18	Persisted	P. vulgaris	>50,000		
5	Right	2 wk.	P. vulgaris	50	1,000	6	14	Stopped in 8 days; recurred	Ps. aeruginosa A. faecalis	>50,000 12.5	Discharge recurred 1 wk. after therapy; cultures then yielded only A. faecalis	3½ mo.
								Group 2				
6	Left	15 yr.	Ps. aeruginosa	...	1,000	6	14	Stopped; recurred	Ps. aeruginosa A. faecalis	>50,000 3.1	Same patient as ear 5; discharge recurred 1 wk. after therapy stopped, with cultures yielding only A. faecalis	3½ mo.
7	Left	14 yr. (recurrent)	Klebsiella pneumoniae, type A Staphylococcus albus	1.6 6.3	25,000	3	13	Stopped in 3 days	None	....	Ear remained dry; patient treated for pneumonia with intramuscular injections of streptomycin; reported as case 4 by Harris and others (New England J. Med. **236**: 611-622 [April 24] 1947)	3 mo.
8	Left	20 yr.	P. vulgaris	50	5,000	4	15	Stopped	A. faecalis	12.5	Ear remained dry after 2 days	4 mo.
9	Right	20 yr.	Staph. albus	...	5,000	4	15	Stopped	Gram-negative bacillus	5,000	Same patient as ear 8; ear remained dry after 5 days	4 mo.
10	Right	25 yr.	Ps. aeruginosa	50	10,000	4	7	Stopped	Ps. aeruginosa	12.5	Ear remained dry after 1 day	3 mo.
11	Left	25 yr.	Ps. aeruginosa	50	10,000	4	7	Stopped in 2 days	Ps. aeruginosa	12.5	Same patient as ear 10; ear remained dry	3 mo.

12	Right	8 yr.	Ps. aeruginosa Staph. albus	100 50	12,500	4	6	Stopped in 2 days	Diphtheroids	....	Ear remained dry	2 mo.
13	Left	10 yr.	Alcaligenes faecalis	12.5	10,000	4	14	Stopped	None	....	Ear remained dry after 4 days	4 wk.
14	Right	10 yr.	Streptococcus lactis Diphtheroids	6.3 1.6	10,000	4	14	Persisted	Str. lactis Staph. albus	12.5 1,000	Same patient as ear 13; drainage of foul pus continued	4 wk.
15	Right	17 yr.	Staph. aureus	3.2	10,000 P 500†	4	51	Stopped in 15 days	A. faecalis	>50,000	Cultures became sterile during treatment; ear remained dry	5 mo.
16	Left	15 yr.	P. vulgaris A. faecalis	12.5 50	10,000 P 500†	4	51	Persisted	P. vulgaris A. faecalis	>50,000 >50,000	Same patient as ear 15; later cleared after 1 week of oral and local sulfonamide therapy	5 mo.
17	Right	1 yr.	P. vulgaris	50	5,000	4	14	Stopped in 14 days	P. vulgaris	>50,000	Ear remained dry	None
18	Left	1 yr.	P. vulgaris	500	5,000 P 500†	4	21	Stopped in 9 days	P. vulgaris	>50,000	Same patient as ear 17; ear remained dry	None
19	Left	21 yr.	Hemolytic Staphylococcus aureus Ps. aeruginosa Gram-negative bacillus Diphtheroids	12.5 25 6.3 5,000	1,000 P 500†	4	8	Stopped in 2 days	Gram-negative bacillus	3.1	Ear remained dry; signs and symptoms of acute mastoiditis began 1 week after treatment ended, but subsided without further therapy in 2 days	5 mo.
20	Left	3 yr.	Ps. aeruginosa	25	12,500	4	22	Stopped in 14 days; recurred	Staph. albus	....	Discharge recurred 1 week after therapy ended; persisted	3 mo.
21	Right	5 yr.	Ps. aeruginosa	200	12,500	4	17	Stopped; recurred	Ps. aeruginosa	25 >50,000	Ear dry for 2 weeks; discharge then recurred; M.I.C. 25 on third day, >50,000 on sixth day and thereafter	1 mo.
22	Left	5 yr.	Ps. aeruginosa	200	12,500	4	17	Stopped; recurred	Ps. aeruginosa	>50,000	Same patient as ear 21; organism resistant on third day	1 mo.
								Group 3				
23	Right	1 yr.	K. pneumoniae	6.3	1,000	4	19	Persisted	Staph. albus	....	Discharge after treatment yielded Ps. aeruginosa; M.I.C. 100	4 mo.
24	Left	1 yr.	K. pneumoniae	6.3	1,000	4	19	Persisted	K. pneumoniae A. faecalis	6.3 50	Same patient as ear 23; discharge after treatment yielded Ps. aeruginosa; M.I.C. 100	4 mo.
25	Right	2 mo.	Ps. aeruginosa	100	12,500	4	12	Stopped for 10 days	Ps. aeruginosa	>50,000	Culture normal on second day; yielded pathogens on fifth day; resistant strain persisted	1 mo.
26	Left	2 mo.	Ps. aeruginosa P. vulgaris	100 50	12,500	4	12	Stopped for 10 days	Ps. aeruginosa	5,000— >50,000	Same patient as ear 25; organism totally resistant after fifth day	1 mo.
27	Left	16 mo.	Ps. aeruginosa Staph. albus	50 25	20,000 P 500†	4	10	Stopped in 2 days	Yeast	....	Ear remained dry; healed	2 mo.

* Minimum inhibiting concentration of streptomycin (i. e., sensitivity), units per cubic centimeter of culture.
† Penicillin incorporated in streptomycin solution, units per cubic centimeter.

Therapy.—All the patients received the streptomycin in local instillations except for 1 patient, who was also given intramuscular injections of streptomycin for chronic bronchiectasis. The streptomycin solutions were made up in 10 to 20 cc. amounts of the desired concentration in sterile isotonic sodium chloride solution and were kept in a refrigerator when not in use. The concentrations of streptomycin most frequently used were 5,000 to 12,500 units per cubic centimeter, but some patients received 1,000, and other 20,000 or 25,000, units per cubic centimeter. Penicillin, in a final concentration of 500 units per cubic centimeter, was incorporated in the solution for instillation in 4 ears, from 3 of which staphylococci had been obtained in the pretreatment cultures.

The external auditory canal of the affected ear was wiped thoroughly with dry, sterile cotton swabs before each instillation. The head was then held with the ear upward and with the canal in a vertical position. With a clean, though not sterile, medicine dropper, about 1 cc. of solution was instilled drop by drop into the canal, which was then plugged with sterile cotton. The head was kept in the same position for from three to five minutes. These treatments were carried out from six to eight times a day by the nursing staff on the 6 patients who were hospitalized. The remaining 12 patients carried out this procedure at home, usually four times daily. The duration of the therapy varied from six to fifty-one days. If the drainage subsided promptly, the instillations were usually discontinued after a week, but as a rule they were kept up for from two to three weeks.

RESULTS

The relevant bacteriologic and clinical data are summarized in table 1.

Bacteriologic Findings Prior to Treatment.—As might be expected in cultures from chronically infected foci constantly subjected to contaminations, the bacteriologic results were not entirely satisfactory. The organisms listed in table 1 were the ones which predominated in the cultures. Most of those which could be isolated and maintained in pure culture were tested for sensitivity to streptomycin.

The organisms most frequently found before the streptomycin therapy was begun were strains of Ps. aeruginosa and of P. vulgaris; they were also the most resistant of the organisms encountered. The 12 strains of Ps. aeruginosa tested were sensitive to streptomycin in solutions of from 25 to 200 units per cubic centimeter, and the minimum inhibiting concentration for the 9 strains of P. vulgaris varied from 12.5 to 500 units per cubic centimeter. Most of the other organisms which grew in the cultures, including the strains of staphylococci and of various gram-negative bacilli, were more sensitive; they were sensitive to from 1.6 to 50 units of streptomycin per cubic centimeter, and most of them were completely inhibited by 12.5 units or less per cubic centimeter. One strain of diphtheroids required 5,000 units per cubic centimeter, but another was completely inhibited by 1.6 units per cubic centimeter.

Clinical and Bacteriologic Results.—The clinical results in the individual ears are noted in table 1 and summarized in table 2. The drainage stopped in 15 of the 27 ears during the course of the local streptomycin treatment and did not recur during the period of follow-up observation, which continued for one to six months (1 patient, with both ears involved, was not followed after the treatment ended). There was temporary improvement in 7 ears. The drainage from these ears stopped for brief periods while they were under treatment but recurred either while streptomycin was still being given or shortly after it was discontinued. In 5 other ears there was little or no benefit from the local streptomycin therapy.

It is of interest that improvement occurred in each of the three groups. While the ears in group 1 were known to have had purulent discharge for only one to six

weeks, some of the ears listed as improved in group 2 and the 1 ear so listed in group 3 had not been free of drainage for many months or years.

From the bacteriologic point of view, it is worth noting that in the ears from which the comparatively resistant organisms, namely, the Pseudomonas and Proteus strains, were obtained, good results were observed at least as often as in those from which other, more sensitive organisms were grown initially. The 15 ears which became and remained dry included 6 from which Ps. aeruginosa was obtained, 4 from which P. vulgaris was isolated, 1 in which both these organisms were present and 4 from which neither of them was grown in the pretreatment cultures.

Appearance of Resistant Strains.—Cultures obtained while the patients were still receiving streptomycin therapy yielded 14 strains of organisms that were totally resistant. Two distinct species of resistant organisms were isolated from each of 2 ears. There were 4 ears, however, in which clinical improvement occurred, the discharge stopped and the ears remained dry in spite of the transient appearance of these resistant strains. Furthermore, 2 of the resistant strains did not correspond

TABLE 2.—*Summary of Clinical Results*

Group	Number of Ears	Results			Number of Resistant Strains †
		Improvement *	Improvement and Relapse	No Improvement	
1	5	3	1	1	4
2	19	11	4	4	8
3	3	1	2	0	2
Total	27	15	7	5	14

* The ear became and remained dry; cultures became sterile.

† Resistant strains listed here were those not inhibited by 50,000 units of streptomycin per cubic centimeter of culture.

In 4 ears (3, 15, 17 and 18) improvement occurred in spite of the transient appearance of resistant strains; in 1 case of bilateral involvement there was no follow-up observation after treatment was stopped.

Two resistant strains (1 each from ears 5 and 15) did not correspond with those obtained in pretreatment cultures.

Two resistant strains of different organisms were obtained from each of 2 ears (ear 3, group 1, and ear 16, group 2).

with the organisms identified in the pretreatment cultures; they may, of course, have been present in small numbers and not been recognized. The strain of P. vulgaris in ear 4 retained the same degree of sensitivity to streptomycin throughout an initial course of treatment for nine days, but became totally resistant during a second course of topical treatment with streptomycin, which was begun eighteen days later. In a few ears some of the original strains persisted without demonstrable changes in sensitivity. In others new strains appeared during or immediately after the course of streptomycin therapy; these strains had and retained sensitivities to streptomycin within the usual range.

COMMENT

One of the main purposes of the present study was to determine whether the development of resistance to streptomycin, a major factor limiting the clinical effectiveness of the drug, could be avoided by the local use of the antibiotic in high concentrations. Evidence suggesting that this method might not be entirely successful is contained in the

results reported briefly by Hirshfeld and his co-workers[8] in the treatment of granulating surfaces with streptomycin applied as a wet dressing in concentrations of 200 to 500 units per cubic centimeter. They found "no significant change in the bacterial flora, most of the organisms which were present at the start of therapy still being present when it was discontinued. During the period of therapy, their resistance to streptomycin increased markedly." The concentrations of streptomycin may have been inadequate, in view of the sensitivity of some of the strains that may be encountered, but details were not given. The granulating areas, however, became red and healthy, and the grafts took well.

Maximum feasible concentrations, which may contain up to 100,000 units of streptomycin per cubic centimeter, were not used in the present study, though they might have given better results. The concentration of the solutions used, however, was twenty or more times as great, in each instance, as the minimum concentration required to inhibit the growth of the organism in vitro, as determined by the usual sensitivity tests. Totally resistant strains, nevertheless, appeared in an appreciable number of ears during treatment, indicating that the concentration of streptomycin to which the organisms are exposed is not the only, or the major, factor determining the appearance of resistant strains during the course of therapy.

Several factors may have interfered with the full effectiveness of streptomycin in the present cases, and thus may have contributed to the failures and, possibly, to the development of resistant strains. The activity of streptomycin is known to be greatly reduced in an acid medium and in the presence of excessive concentrations of bacteria,[9] factors which may both have been operative in the purulent otitic exudates. Furthermore, some of the organisms may have been present in situations inaccessible to the locally instilled streptomycin, and were thus protected from its action. This may explain the persistence of susceptible organisms in some of the ears. The most likely explanation, however, is that the resistant variants are present, usually in very small numbers, from the start, and that the exposure to the antibiotic serves to eliminate most of the sensitive bacteria, leaving the resistant ones to multiply. Such an explanation is consistent with the very rapid appearance of totally resistant strains in other circum-

8. Hirshfeld, J. W.; Buggs, C. W.; Pilling, M. A.; Bronstein, B., and O'Donnell, C. H.: Streptomycin in the Treatment of Surgical Infections: Report of Experiences with Its Use, Arch. Surg. **52**:387-401 (April) 1946.

9. Abraham, E. P., and Duthie, E. S.: Effect of p_H of the Medium on Activity of Streptomycin and Penicillin and Other Chemotherapeutic Substances, Lancet **1**:455-459 (March 30) 1946.

stances, as, for example, during treatment with streptomycin of infections of the urinary tract.[10]

While emphasis has been placed on the therapeutic failures, particularly from the bacteriologic point of view, the highly favorable results obtained in more than half the cases in this exploratory study should not be ignored. The clinical results in some of the cases in the present series are sufficiently impressive to warrant further investigation of local streptomycin therapy of chronic otitis with a view to developing modifications which would increase its effectiveness and reduce the frequency with which resistance strains appear. Several possibilities suggest themselves: (1) increase in the concentration of the streptomycin solutions and perhaps more frequent instillations; (2) lavage or irrigation with alkaline solutions prior to the instillations; (3) combinations of streptomycin with other chemotherapeutic or antibiotic agents, including pencillin, tyrothricin, sulfonamide drugs (the sodium salts in solution, in suitable concentration, might provide both a proper p_H and enhanced bacteriostatic activity) or some of the newer antibiotics or chemotherapeutic agents that may be ineffective by themselves; (4) methods to increase diffusion of the instilled materials through the middle ear cavity and (5) prolonged systemic therapy with streptomycin and the other antibacterial agents, in addition to topical applications. These methods, if used to supplement surgical procedures intended to eradicate foci by clearing away necrotic debris, should offer a better opportunity for the antibacterial agents to work and promote more rapid healing.

SUMMARY AND CONCLUSIONS

Bacteriologic and clinical observations were made in 27 ears with suppurative otitis, under treatment with local instillations of streptomycin solutions. Clinical improvement occurred in about half these ears. Drainage stopped during the treatment and did not recur during a follow-up period of from one to six months. Resistant strains of organisms previously susceptible to streptomycin appeared during the course of treatment in a large proportion of the cases in spite of the fact that the concentration of the streptomycin instilled was at least twenty times as great as the minimum concentration required to inhibit the organisms isolated before treatment was started. The highly favorable results in some of the cases in which the condition had failed to improve under other forms of therapy suggest that local streptomycin therapy may be useful in certain cases of suppurative otitis with organisms susceptible to streptomycin. Certain modifications which may enhance the efficacy of the therapy are suggested.

10. Finland, M.; Murray, R.; Harris, H. W.; Kilham, L., and Meads, M.: Development of Streptomycin Resistance During Treatment, J.A.M.A. **132**:16-21 (Sept. 7) 1946.

ANNOYING POSTOPERATIVE PROBLEMS IN OTO-RHINOLOGIC PLASTIC SURGERY

FRANK TURCHIK, M.D.
BRIDGEPORT, CONN.

MANAGEMENT of the many annoying postoperative problems in otorhinologic plastic surgery demands a broad knowledge of general medicine, careful diagnostic methods and the exercise of mature surgical judgment. One must never lose sight of the fact that one's patient is an indivisible entity and that one is fundamentally a physician.

A careful medical history may elicit nothing regarding blood dyscrasia and nothing regarding acute or chronic disease, metabolic or otherwise; the complete blood count, serologic reactions, bleeding time, coagulation time and results of urinalysis may be within normal limits; yet one patient may show tremendous postoperative ecchymosis and swelling, whereas a second patient, subjected to the same careful technic, with sharp instruments and an experienced operator, and the same preoperative medication, will show negligible ecchymosis and edema. Unquestionably, as a surgeon perfects his technic and becomes more deliberate in each movement, the incidence of these annoying factors becomes less common; but they do occur.

To what variable factor can this situation be attributed? It is known that capillary permeability may vary in normal persons with normal blood pictures. Fairly reliable methods to demonstrate preoperatively the varied degrees of capillary permeability or weakness, and factors influencing them, have been reviewed in the literature.[1]

I have been using the Rumpel-Leede tourniquet test with the "flicking" test suggested by Jones and Tocantins.[2] Although tests for capillary fragility are not considered conclusive, I have found the following procedure of value in predicting the occurrence of ecchymosis after rhinoplasty.

Read at the meeting of the American Otorhinologic Society for the Advancement of Plastic and Reconstruction Surgery, Atlantic City, N. J., June 11, 1947.

1. Goldman, L., and Corrill, E. M.: Studies in Some Capillary Fragility States in Dermatology: Effect of Hesperidin and Hesperidin Methyl Chalcone, J. Invest. Dermat. **6**:129 (April) 1945.

2. Jones, H. W., and Tocantins, L. M.: A Simple Test for Capillary Resistance: The "Flicking" Test, Am. J. M. Sc. **185**:535 (April) 1933.

The antecubital fossa is first inspected for areas of pigmentation which might later be mistaken for petechiae, and these are encircled with ink. A blood pressure cuff is applied in the usual manner above the elbow and inflated. Pressure is maintained slightly above diastolic for five minutes. At the end of four minutes, the distended veins in the antecubital fossa are flicked with the thumb and middle finger of the examiner. After removal of the cuff, an area of 7.5 by 5 cm. below that where the cuff was applied is inspected with an ordinary reading glass for petechiae.

The results in 50 patients examined in this manner previous to rhinoplasty may be summarized as follows: Patients with from no to 8 petechiae almost uniformly had very little postoperative ecchymosis about the eyes, and this disappeared completely in four to five days; patients with 8 to 20 petechiae had moderate amounts of postoperative ecchymosis, lasting from ten days to two weeks, and those with more than 20 petechiae had ecchymosis that dissected under the skin of the face to the mandible and sometimes into the skin of the neck and chest.

Lucia and Aggeler[3] described a familial type of simple, easy bruisability in women of fair complexion and thin-textured skin who had an unusual combination of physical sluggishness and mental hyperirritability. Blood findings in these patients are within normal limits, but menstrual dysfunction and a low basal metabolic rate without evidence of thyroid insufficiency indicate a probable endocrine basis for this pseudopurpuric state. Three patients in this category were treated in the past six months, with small doses of thyroid and a vitamin K preparation. With the tourniquet test, they showed 12, 15 and 20 petechiae, respectively. Postoperative ecchymosis was slight and disappeared within seven to ten days in all of them.

All physicians have observed the increased nasal congestion in women just prior to and during the menstrual period. At this time, there is an increase in the sodium ion concentration of the blood stream, resulting in withholding of fluids in the body tissues and diminished urinary output. In an as yet unpublished report from the research laboratories of McKesson and Robbins, Inc., on their clinical experimentation with orally administered penicillin, Golden and his co-workers note that there is a diminished urinary output during the premenstrual period, but that there is also an increase in the total excretion of penicillin. The latter would suggest a greater capillary permeability or capillary weakness. The more frequent incidence of bleeding, ecchymosis and postoperative swelling occurring in patients operated on just before, or during, the first few days of the menstrual period

3. Lucia, S. P., and Aggeler, P. M.: Simple Easy Bruisability: Pseudohemorrhagic Diathesis of Probable Endocrine Origin, J. Clin. Endocrinol. **2**:457 (July) 1942.

may be explained on this basis. Numerous reports in the literature, by Rudel,[4] Brewer,[5] Walters [6] and others, corroborate this observation of increased capillary weakness just before and during menstruation, and of a rapid return to normal after the third or fourth day of menstruation. These facts suggest that rhinoplasty should not be performed just before or during the first two or three days of menstruation.

In 3 patients operated on during the menstrual period, considerable ecchymosis about the eyes resulted and lasted for three weeks. One patient had a small, permanent deposit of blood pigment in the lower eyelids. Tourniquet tests done on these patients many months after the operation, but on the first day of menstruation, showed 20, 12 and 24 petechiae, respectively. Another rhinoplasty was performed on a patient who was menstruating at the time of operation and who showed a normal blood picture and 14 petechiae in the test. Sodium chloride was withheld, and potassium chloride was administered for forty-eight hours before and after operation. Three milligrams of synkamin® (vitamin K preparation) was given intramuscularly the night before, and the dose was repeated on the morning of the operation. This patient had a minimal amount of ecchymosis, which disappeared entirely in ten days. To be sure, no definite conclusions can be drawn from isolated cases or from small series of cases, but reports of this type may provide a stimulus for further study along these lines.

Numerous remedies for capillary weakness have been recommended, tried and discarded. In a recent article on the relation of vitamin C to capillary fragility, Bicknell and Prescott stated that "there is a growing body of evidence negativing any relationship between them." [7] It is believed, however, that vitamin C is a valuable adjunct in stimulating wound healing.

The work of Rusznyák, Szent-Györgyi and Bruckner [8] on vitamin P isolated from lemon juice, and later from lemon peel, has stimulated considerable scientific research on the use of this substance in reducing capillary weakness. The glowing reports in the literature by Griffith,

4. Rudel, I.: Capillary Resistance in Relation to the Menstrual Cycle in Women, Klin. Wchnschr. **20**:266 (March 15) 1941.

5. Brewer, J. I.: Rhythmic Changes in Skin Capillaries and Their Relation to Menstruation, Am. J. Obst. & Gynec. **36**:597 (Oct.) 1938.

6. Walters, J. D.: Capillary Fragility and Allied Tests, Ohio State M. J. **41**:632 (July) 1945.

7. Bicknell, F., and Prescott, F.: The Vitamins in Medicine, ed. 2, New York, Grune & Stratton, Inc., 1946.

8. Rusznyák, S., and Szent-Györgyi, A.: Vitamin P: Flavonals as Vitamins, Nature, London **138**:27 (July 4) 1936. Szent-Györgyi, A.: Deutsche med. Wchnschr. **62**:1326, 1936. Bruckner, V., and Szent-Györgyi, A.: Chemical Nature of Citrin, Nature, London **138**:1057 (Dec. 19) 1936.

Couch and Lindauer[9]; Warter, Drezner and Horoschak,[10] and Shanno[11] and many others attest to the efficacy of this new active principle in controlling capillary weakness. Goldman and Corrill,[1] in a paper on states of capillary fragility in dermatology, concluded that "transient and at times striking decreases in the positive capillary fragility test were noted occasionally immediately after the intravenous use of hesperidin methyl chalcone [a derivative of vitamin P]." Vitamin P should develop into a valuable aid in the control of ecchymosis following rhinoplasty.

As knowledge of vitamin P is the outgrowth of nutritional research, a few additional comments on nutrition should not be amiss. As an aftermath of World War II, because of the starvation and malnutrition in enemy prison camps, many nutritional problems have been investigated. Deficiency in one or more of the nutritional elements may delay convalescence and impair the powers of combating infection. The incidence of postoperative hypoproteinemia has received considerable attention. Scobey,[12] in an article on unrecognized "borderline" protein deficiency, stated that animal protein deficiency will not respond to vitamin or drug therapy, but will respond to the administration of protein hydrolysate. The use of partially hydrolyzed protein in concentrated form supplies all the essential amino acids necessary for rapid reparative processes.

Griesman[13] pointed out the danger of administering a solid diet to a patient after rhinoplasty, due to bone stresses and strains. I have recently used "essenamine" (a partially hydrolized protein) during the first week after rhinoplasty, with gratifying results both in comfort for the patient and in more rapid convalescence. For an occasional patient with a previous history of alcoholism, or for one suffering from postoperative psychic nausea and vomiting, daily doses of 1 ampule

9. Griffith, J. Q., Jr.; Couch, J. F., and Lindauer, M. A.: The Effect of Rutin on Increased Capillary Fragility in Man, Proc. Soc. Exper. Biol. & Med. **55**:228 (March) 1944. Griffith, J. Q., Jr., and Lindauer, M. A.: Increased Capillary Fragility in Hypertension: Incidence, Complications and Treatment, Am. Heart J. **26**:758 (Dec.) 1944.

10. Warter, P. J.; Drezner, H. L., and Horoschak, S.: Effect of Hesperidin and Ascorbic Acid on Capillary Fragility in Rheumatoid Arthritis, J. M. Soc. New Jersey **43**:228 (June) 1946.

11. Shanno, R. L.: Rutin: A New Drug for the Treatment of Increased Capillary Fragility, Am. J. M. Sc. **211**:539 (May) 1946.

12. Scobey, R. R.: Protein Deficiency Conditions Observed in Private Practice, New York State J. Med. **46**:1691 (Aug. 1) 1946.

13. Griesman, B. L.: Structure of External Nose: Study from Point of View of Plastic Surgery, Arch. Otolaryng. **42**:117 (Aug.) 1945.

of "solu B" [14] with vitamin C administered intravenously were of great benefit. This treatment was particularly helpful in the immediate post-traumatic period in cases of nasal, maxillary or zygomaticomalar fracture. On two occasions, however, during its prolonged use, a severe, generalized, exfoliative dermatitis developed, which proved most annoying for a few days, but cleared up when the medication was discontinued.

Kartavin,[15] in his work on the pathogenesis of postoperative hematomas, stated that blood coagulation was increased in the majority of a group of patients with psychologic shock. Postoperative coagulation of the blood was immediate in these patients. This observation, he stated, had been corroborated by others.

Last to be considered is the person with allergy. Since the introduction of the sulfonamide drugs and the antibiotics, the incidence of infection has subsided materially but the incidence of known allergy has mounted tremendously. This increment may be attributed to the more skilled methods of diagnosis of allergic conditions, but one feels that these drugs have probably been a factor in materially sensitizing the population. I have seen severe allergic reactions, delaying healing for many weeks, develop in patients with latent, unrecognized allergies who had been subjected to Killian's operation. Frequently, after rhinoplasty, the allergic patient will have edema of the nose and lower eyelids that persists for months. Occasionally a few weeks may intervene after normal regression of postoperative edema. Edema associated with pain and tenderness may then develop along the nasofacial sulcus, lower eyelids or septum, due to an activated allergy that before operation was latent and unrecognized. This persistent edema may occasionally interfere with normal shrinkage of the skin, interpose soft tissue between alined bony structures, resulting in a wide bridge, or cause a permanent fulness behind the nasal tip.

A careful personal and family history should elicit confirmation, or at least suspicion, of an allergic condition, if one is present. When one is in doubt, examination of nasal smears for eosinophils, and frequently, but not invariably, observation of an increase in the number of eosinophils in the blood may clear up the picture. Complete testing, desensitization, when possible, and exclusion of the offending allergen should be carried out prior to any surgical procedure on the nose, and an elimination diet should be ordered. Whether the allergy is seasonal or perennial,

14. One ampule contains a mixture of thiamine hydrochloride, 10 mg., riboflavin, 10 mg., pyridoxine hydrochloride, 5 mg., calcium pantothenate, 50 mg., and nicotinamide, 250 mg., in powder form for injection after proper solution has been effected.

15. Kartavin, V. A.: Pathenogenesis of Post-Operative Hematomas, Vestnik khir. **61**:19 (Jan.) 1941.

operation should not be performed on the nose during any of the seasons when allergy is prevalent. As preliminary medication, one of the antihistamine drugs administered from twenty-four to forty-eight hours prior to operation and continued postoperatively should help greatly to avoid annoying sequelae. There is a divergence of opinion as to the effect of allergic states on capillary permeability. Castex and his co-workers [16] used the "suction cup method" to determine capillary permeability in an analysis of 100 cases of proved allergy, and reported no important changes with the state of allergy. In my own patients, using the tourniquet test and postoperative clinical observation, I found that capillary permeability was increased in the presence of allergic states. As early as 1914, Sir William Osler made the following comment in discussing purpura:

> The anaphylactoid purpuras are so-called because they are characterized by one or more of the common changes observed in allergy like oedema, urticaria or angioneurotic oedema. These conditions are not due to thrombocytopenia or other hematopoietic disturbances but to increased capillary permeability allowing the passage of plasma or blood into the tissues. The etiology is unknown but is sometimes found to be due to allergic sensitization in which cases the purpura and associated oedema are more properly termed allergic purpura.[17]

COMMENT

In describing some of the annoying postoperative problems encountered in nasal surgery, I do not pretend to give the solution. The observations presented are based on too few cases to be conclusive. If I have stimulated some interest in the solution of these problems and demonstrated that otorhinologic plastic surgery demands a broad knowledge of general medicine, careful diagnostic methods and the exercise of skilled, mature surgical judgment, I am satisfied.

1831 Barnum Avenue.

16. Castex, M. R.; Ruiz Moreno, G., and Solari, M. A.: Capillary Fragility in Allergic Patients, An. d. Inst. invest. fis. apl. a la pat. humana **3**:147, 1941.

17. Osler, W.: The Visceral Lesions of Purpura and Allied Conditions, Brit. M. J. **1**:517, 1914.

Clinical Notes; New Instruments and Technics

IMPROVED BRONCHOSCOPIC GLASSES

MILTON S. LLOYD, M.D.
NEW YORK

A DESCRIPTION of these glasses first appeared in the ARCHIVES in August 1933.[1] An additional feature has since been added, which is of great value to the bronchoscopist.

The glasses consist of an ordinary frame into which lenses may be fitted. A hole is drilled through the bridge between the lens and the ear piece on each side and a bolt is inserted which serves as a center for a thin glass disk from 7.5 to 8 cm. in diameter. The disk may be rotated and provides protection for the eyes against material coughed out of the bronchoscope, as well as unlimited clear visual fields in case the glass is soiled.

If corrective lenses are necessary, particularly for presbyopia, the oculist's prescription may be divided in such a way as to give proper definition at the varying distances represented by the standard endoscopic tubes.

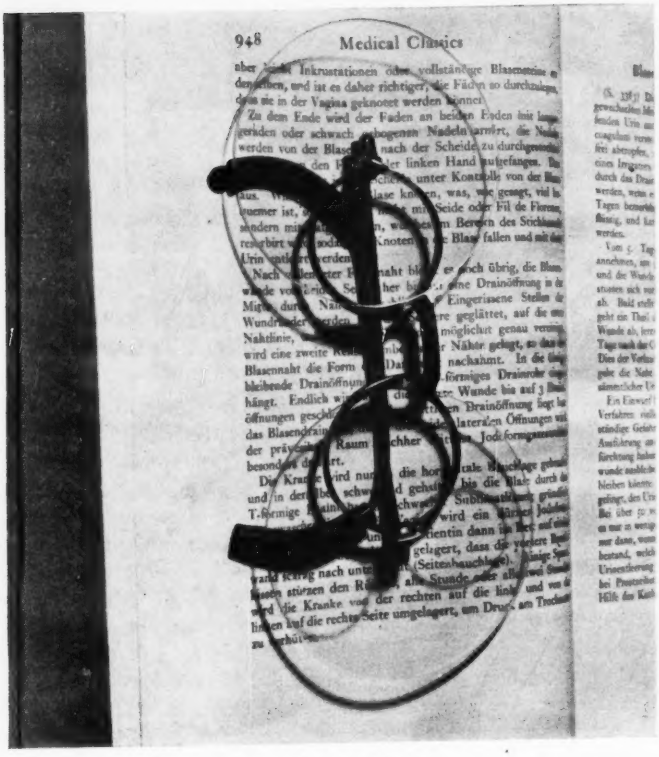
Part of the prescription is mounted in the frame as an ordinary lens. The remainder is divided as necessary for the individual case among two or more lenses which are mounted on the rotary disk.

In this way the bronchoscopist who requires exact vision at varying focal distances can adjust his prescription to suit the necessity of the moment by the simple maneuver of turning the rotary disk.

The accompanying figure illustrates the glasses. The adjustments in this case are for three focal distances, viz., 20 to 35 cm., 30 to 50 cm. and 45 to 65 cm.

667 Madison Avenue.

1. Lloyd, M. S.: Bronchoscopic or Surgical Glasses, Arch. Otolaryng. **18**:201 (Aug.) 1933.



Bronchoscopic glasses

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

TUMORS OF THE NOSE AND THROAT

GORDON B. NEW, M.D.
AND
EDWARD L. FOSS, M.D.
ROCHESTER, MINN.

TUMORS OF THE SALIVARY GLANDS

MUCOEPIDERMOID tumors of the salivary glands were studied recently by Stewart, Foote and Becker.[1] Forty-five tumors of this type were noted in a series of 700 patients with major and minor tumors of the salivary gland, examined at Memorial Hospital for Cancer and Allied Diseases between 1928 and 1943. None of the mucoepidermoid tumors had the structural characteristics of a mixed tumor or of a tumor of the salivary glands.

Quattlebaum, Dockerty and Mayo[2] observed that 10 per cent of a consecutive series of primary neoplasms of the parotid gland were adenocarcinomas of the cylindroma type. Surgically, these adenocarcinomas generally appeared infiltrative rather than encapsulated, and application of the principle of wide local excision prevented recurrences in 5 of the 21 cases. Pathologically, the appearance of dark-staining epithelial islands and strands, with central honeycombing in a hyaline stroma, was diagnostic. Epithelial mucus was present in some of the tumors. Infiltrative tendencies were pronounced, and there was a special predilection for invasion of nerve sheaths. In 8 of the 20 cases in which follow-up data were available, the patients died of metastatic lesions within five years; in 5 of the 8 cases there was evidence of pulmonary involvement. Two of the 20 patients died more than five years after operation, and 4 of the remaining 10 patients had "inoperable," recurrent tumors. The authors conclude that solid tumors of

From the Section on Laryngology, Oral and Plastic Surgery, the Mayo Clinic.

1. Stewart, F. W.; Foote, F. W., and Becker, W. F.: Muco-Epidermoid Tumors of Salivary Glands, Ann. Surg. **122**:820-844 (Nov.) 1945.

2. Quattlebaum, F. W.; Dockerty, M. B., and Mayo, C. W.: Adenocarcinoma, Cylindroma Type, of the Parotid Gland: A Clinical and Pathologic Study of Twenty-One Cases, Surg., Gynec. & Obst. **82**:342-347 (March) 1946.

the parotid gland should be assumed to be malignant until proved otherwise, and they suggest that more radical surgical procedures will have to be used to obtain better results in the treatment of this form of neoplasm.

Two cases of unusually large tumors of the neck are reported by Dixon and Benson.[3] In the first case, the tumor was a hyperfunctioning, adenomatous goiter which weighed 1,075 Gm. In the second case, the tumor was an adenocarcinoma of the parotid gland of the mixed type and weighing 2,100 Gm. The authors stress the importance of adequate exposure in the surgical management of large cervical tumors. In the removal of large goiters, the trachea should be located to facilitate tracheotomy, if this becomes necessary. If part of the goiter is intrathoracic, the superior pole of the thyroid gland and the superior thyroid vessels should be isolated, doubly ligated and divided before one attempts to elevate the intrathoracic portion of the goiter. The dead space left by removal of the goiter should be drained with a strip of finely woven gauze. Mixed tumors of the parotid gland are almost invariably malignant histologically, but they rarely metastasize. In the removal of large tumors of the parotid gland, avoidance of injury to the external carotid artery is of prime importance. It is safer to ligate the common carotid artery than the internal carotid artery. The facial nerve should be preserved if possible. Postoperative radium therapy is advisable.

Hellwig[4] reviews the data on 82 primary tumors of the salivary glands studied in the laboratory of St. Francis Hospital, Wichita, Kan., in the past twenty years. From embryologic, histologic and topographic studies, it is concluded that mixed tumors of the salivary glands are derived from misplaced elements of the notochord. This view would explain not only the complex structure of mixed tumors but also the striking predilection of these tumors for the parotid glands.

TUMORS OF THE NOSE AND ACCESSORY SINUSES

The genesis, diagnosis and treatment of typical and atypical cysts of the nasal floor are considered by Bernfeld.[5] Eight cases of tumors of the nose or the accessory sinuses are reported. Berger[6] reports

3. Dixon, C. F., and Benson, R. E.: Surgical Management of Large Tumors of the Neck, Am. J. Surg. **69**:384-390 (Sept.) 1945.

4. Hellwig, C. A.: Mixed Tumors of the Salivary Glands, Arch. Path. **40**:1-10 (July) 1945.

5. Bernfeld, K.: The Genesis of Typical and Atypical Cysts of the Nasal Floor, J. Laryng. & Otol. **60**:145-159 (April) 1945.

6. Berger, M. D.: Neoplasms of Both Maxillary Sinuses, Arch. Otolaryng. **42**:397-403 (Nov.-Dec.) 1945.

the case of a patient 62 years of age who had a malignant lesion in each maxillary sinus. The two lesions were distinct entities; the second developed while the patient was under observation for the first.

TUMORS OF THE LIPS AND MOUTH

Thoma and Blumenthal [7] report the occurrence of cysts in three generations of one family. In the first generation, the father had excellent teeth, but a cyst developed in the region of the lower left canine and was removed when he was 78 years of age; the mother had very poor teeth. In the second generation, there were two sons and three daughters. One son and 2 daughters had cysts, and the remaining son and daughter were heterozygotes; the dental characteristic was recessive and was transmitted to their children, in whom cysts developed. One son had 3 children, of whom 1 daughter had three cysts. One daughter had 2 children, 1 of whom had three cysts; the other child was not examined. Another daughter had 5 children, 2 of whom had cysts. The third daughter was operated on by Thoma thirteen years prior to the report for an infected dentigerous cyst connected with an unerupted left canine tooth in the upper jaw. She had eleven children, five boys and six girls. Ten of these children were examined, and cysts were found in 4. It is interesting to note that 3 of these children, 1 boy and 2 girls, had cysts similar to their mother's, all of which formed from the corresponding tooth on the other side, the right maxillary canine.

To prevent the recurrence of cysts involving the ramus of the mandible, Walker [8] has devised the following procedure: An incision is made from the molar region upward on the anterior border of the ramus. The tissues are widely reflected, and the cavity of the cyst is opened; after adequate removal of bone, this opening is enlarged and the lining of the cyst is removed. In the case of a dentigerous cyst, the offending tooth is extracted. The edges of the bone are trimmed. The final stage consists in inserting a stent mold carrying a Thiersch graft to cover the raw margins of the orifice. Adequate stabilization of the mold is achieved with silk sutures. After the mold has been removed, the opening is maintained by a plug attached to a denture.

Ivy and Curtis [9] state that the treatment for sublingual dermoid cysts is complete enucleation. They advise that if the mass is situated immediately beneath the mucous membrane it is possible that it can

7. Thoma, K. H., and Blumenthal, F. R.: Heredity and Cyst Formation, Am. J. Orthodontics **32**:273-281 (May) 1946.

8. Walker, D. G.: Cysts Involving the Ramus of the Mandible, Proc. Roy. Soc. Med. **38**:451 (June) 1945.

9. Ivy, R. H., and Curtis, L.: Two Cases of Sublingual Dermoid and a Case of Protrusion of Mandible, Am. J. Orthodontics **31**:666-675 (Nov.) 1945.

be removed from within the mouth by a free incision and blunt dissection; it is, however, usually preferable to approach it from below. They describe the differential diagnosis of dermoid, ranula and thyroglossal cyst and report 2 cases of sublingual dermoid cyst.

Millhon and Parkhill [10] report an unusual case in which a myxomatous tumor, contiguous with an unerupted lower left third molar tooth, simulated a dentigerous cyst in roentgenograms. The patient, a man aged 38, had an encapsulated tumor lying distal to the tooth. The tumor was about 3 cm. in diameter and, at the expense of the bone, had extended well into the ascending ramus.

Byars and Sarnat [11] state that the ameloblastoma is found most frequently near the angle of the mandible in young adults and describe their treatment. This tumor grows slowly, and unless it is completely removed it will continue to grow. The ameloblastoma seldom becomes truly malignant. Curettage, cauterization with drugs and irradiation are inadequate therapeutic measures. The lesion should be completely enucleated if it is unilocular, cauterized by heat if it is not too large and is multilocular or resected with a small amount of normal bone if it is extensive. These are the best methods of treatment, because they give the greatest assurance that no part of the tumor will be left. The surgical approach and procedure for various types of ameloblastomas and the necessary subsequent reconstructional surgery are considered.

Burford and Ackerman [12] present a second symposium on neoplastic lesions occurring about the oral cavity. Among the lesions they consider are plasma cell myeloma involving the mandible, angioendothelioma (Ewing) of the mandible, carcinoma of the buccal mucosa, extensive ameloblastoma of the jaw and carcinoma of the lower lip.

"Chutta cancer" of India is described by Khanolkar and Suryabai.[13] This is a carcinoma of the hard palate which clinicians regard as due to irradiation from the habitual smoking of a cigar called a chutta with its burning end inside the mouth. Hospital records indicate that leukoplakic lesions of the hard palate are frequently observed among chutta smokers. A carcinomatous process commences in an area of altered, opaque epithelium or, more frequently, starts as a small ulcer

10. Millhon, J. A., and Parkhill, E. M.: A Myxomatous Tumor Simulating a Dentigerous Cyst, J. Oral Surg. **4**:129-132 (April) 1946.

11. Byars, L. T., and Sarnat, B. G.: Surgery of Mandible: Ameloblastoma, Am. J. Orthodontics **32**:34-46 (Jan.) 1946.

12. Burford, W. N., and Ackerman, L. V.: Symposium on Nineteen Cases of Benign and Malignant Lesions of the Oral Cavity, from the Ellis Fischel State Cancer Hospital, Columbia, Missouri, Am. J. Orthodontics **31**:551-555 (Sept.) 1945.

13. Khanolkar, V. R., and Suryabai, B.: Cancer in Relation to Usages: Three New Types in India, Arch. Path. **40**:351-361 (Nov.-Dec.) 1945.

or a button-like nodule in a deeply congested, irritated patch of mucous membrane. "Khaini cancer" also is considered. The inhabitants of Bihar, particularly men, are addicted to the use of khaini, a mixture of a powder of dried tobacco leaves and a small amount of lime. This is carefully rubbed in the palm of the left hand with the thumb of the right hand until the desired mixture is obtained. A pinch of the mixture is then deposited in the groove between the front teeth and the lower lip and left until it gradually becomes diluted with saliva and is swallowed. It is replaced with a fresh mixture at frequent intervals during the day. The resulting changes in the mucosa had not been carefully studied at the time of their report, but in a number of cases a superficial ulcerative process commences in a red, congested mucosa lining the gums and lip. The supervening growth is a squamous cell carcinoma, of the type usually seen in the buccal mucosa.

A series of 242 cases of carcinoma of the lip is reviewed by Charteris.[14] He states that, since the results of treatment in the majority of cases of carcinoma of the lip are known in about a year, his series includes cases in which operation was performed up to a year before the time of his report, in 1944.

Lawrence and Brezina[15] report a consecutive series of 145 cases of carcinoma of the oral cavity treated at the New Haven Hospital from Jan. 1, 1931 to Dec. 31, 1940. They state that the treatment of carcinoma of the mouth and pharynx is essentially a radiologic problem. The best results were attained after treatment of lesions of the buccal mucous membrane and the anterior portion of the tongue. In these groups, a five year survival rate of 23 per cent was obtained. The poorest result was found in the group with hypopharyngeal carcinoma, in which the survival rate was 8 per cent.

TUMORS OF THE NASOPHARYNX

Whiteleather[16] considers transitional epithelial cell carcinoma of the nasopharynx from the standpoints of historical background, pathology, clinical observations and therapy. He states that irradiation is the accepted method of treatment of this type of carcinoma and that at present it offers the most hope, whether it be of complete arrest or of palliation. Patients treated before cervical metastasis or intracranial extension has occurred can expect the best results.

14. Charteris, A. A.: Carcinoma of the Lip and Its Treatment by Radium (1928-1944), Brit. M. J. **1**:719-721 (May 11) 1946.

15. Lawrence, E. A., and Brezina, P. S.: Carcinoma of the Oral Cavity: A Ten Year Survey in a General Hospital, J. A. M. A. **128**:1012-1016 (Aug. 4) 1945.

16. Whiteleather, J. E.: Transitional Epithelial Cell Carcinoma of the Nasopharynx, Am. J. Roentgenol. **54**:357-369 (Oct.) 1945.

An exhaustive study of 454 cases of malignant lesions of the nasopharynx is presented by Godtfredsen,[17] who collected cases from the radiologic clinics of Denmark and Sweden. The diagnosis of the condition was verified histopathologically in the majority of cases. In the small number of cases in which microscopic data were wanting, clinical examinations indicated that the lesions obviously were malignant. Ophthalmoneurologic symptoms were present in 172, or 38.0 per cent, of the 454 cases. Nasopharyngeal tumors constituted about 0.8 per cent of the malignant tumors observed in the radiologic clinics. In a population of about 7,500,000 persons, the mortality rate due to all malignant lesions was about 0.005 per cent (about 1 in 200,000). Malignant lesions of the nasopharynx constituted about 0.4 per cent of all malignant lesions.

The symptoms, pathology, diagnosis and treatment of tumors of the nasopharynx are considered by Nielsen.[18] Of 10,721 malignant tumors in all sites, only 77 (0.75 per cent) were situated in the nasopharynx. The results of treatment are analyzed.

TUMORS OF THE LARYNX

Orton[19] reviews the literature on the larynx and on laryngeal surgery for 1945. Thirty-one articles are included in his bibliography.

From a consideration of the causes and prevention of edema of the larynx caused by radiotherapy, Jolles[20] concludes that as probably no single factor is ever responsible for edema, no single measure can be effective in combating the conditions. He recommends the adoption of some general type of therapy and describes measures for combating edema.

The physical requirements for a substitute voice are an air chamber and a glottis capable of vibrating. Gatewood[21] expresses the opinion that the esophageal orifice should lend itself well to the functions of the glottis. In some instances patients have considerable difficulty in aspirating air or in belching. In such cases, he recommends insertion

17. Godtfredsen, E.: Ophthalmologic and Neurologic Symptoms at Malignant Nasopharyngeal Tumors: A Clinical Study Comprising Four Hundred and Fifty-Four Cases, with Special Reference to Histopathology and the Possibility of Earlier Recognition, Acta psychiat. et neurol., 1944, supp. 34, pp. 1-323.

18. Nielsen, J.: Roentgen Treatment of Malignant Tumors of the Nasopharynx, Acta radiol. **26**:133-154, 1945.

19. Orton, H. B.: A Review of the Available Literature on the Larynx and Laryngeal Surgery for 1945, Laryngoscope **56**:61-84 (March) 1946.

20. Jolles, B.: Causes and Prevention of Radiotherapeutic Oedema of Larynx, Brit. J. Radiol. **18**:278-283 (Sept.) 1945.

21. Gatewood, E. T.: A Simple and Practical Procedure for Developing Esophageal Voice in the Laryngectomized Patient, Ann. Otol., Rhin. & Laryng. **54**:322-327 (June) 1945.

of a small, semiflexible catheter through the nose and into the esophagus so that the distal end of the catheter rests in the upper third of the esophagus, and the catheter is then anchored to the tip of the nose. Air is furnished the esophagus by gentle pressure on a bulb attached to the proximal end of the catheter. With persistent effort, the patient is induced to relax after prolonged expiration and, at the same time, to compress the bulb rapidly but gently. After many repetitions of procedure sound is eventually attained.

Members of the Section of Laryngology of the Royal Society of Medicine discussed the treatment of carcinoma of the larynx at their meeting on Feb. 2, 1945. Davis reviews 40 cases of early intrinsic carcinoma of the larynx in which laryngofissure was performed, and Colledge and Lederman state their views on the subject.[22]

Watson and Lambert[23] describe a method of treating carcinoma of the larynx in which the thyroid cartilage on the affected side is removed and roentgen radiation is applied directly to the exposed underlying surface. When applied in this way, the roentgen rays do not pass through the cartilage before reaching the lesion.

Laryngofissure is the treatment favored by Hare and Hoover whenever possible.[24] However, of a series of patients reviewed by these men, only 1 in 4 was seen early enough to be treated by laryngofissure. The authors state that they prefer irradiation to laryngectomy when laryngofissure is not advisable.

Eighty-eight cases of cancer of the larynx and pharynx, at the Charity Hospital of Louisiana during the four year period from 1939 to 1942, inclusive, are reviewed by Garcia, Schlosser and Marino.[25] In all the cases in this series the lesions were inoperable for either technical or clinical reasons. Irradiation was the only treatment employed. The three year survival rate was 24 per cent. For 47 cases in which the patients were observed for more than five years, the survival rate was 21 per cent.

Serial histologic study of specimens obtained by laryngofissure would prevent delay in the management of residual malignant lesions.

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22. Davis, E. D. D.; Colledge, L., and Lederman, M.: Discussion on Treatment of Carcinoma of the Larynx, J. Laryng. & Otol. **60**:218-231 (May) 1945.

23. Watson, T. A., and Lambert, V.: Results of Treatment of Carcinoma of the Larynx by X-Ray at Operation, J. Laryng. & Otol. **60**:174-177 (April) 1945.

24. Hare, H. F., and Hoover, W. B.: The Treatment of Carcinoma of the Larynx, North Carolina M. J. **7**:93-98 (March) 1946.

25. Garcia, M.; Schlosser, J. V., and Marino, J. B.: Cancer of the Larynx and of the Pharynx: Results of Radiation Therapy at Charity Hospital, New Orleans M. & S. J. **98**:483-490 (May) 1946.

To demonstrate this, Snitman [26] cites the case of a 40 year old woman who had a laryngeal carcinoma removed by laryngofissure. The tumor appeared to have involved only the middle and anterior thirds of the left true cord, and to have been removed completely. Microscopic study, however, revealed incomplete removal of the lesion, which had involved the right true cord.

In cases of laryngeal carcinoma in which the tumor tissue approaches the anterior commissure, Patterson [27] advocates opening the larynx in the following manner: The thyroid cartilage, which may be ossified, is cut in the middle line in such a manner as to avoid injury to the underlying soft tissues. A parallel incision is then made about ¼ inch (0.64 cm.) from the central incision through the thyroid cartilage on the unaffected side of the larynx. The small linear portion of thyroid cartilage lying between the incisions is removed. An incision is then made in the middle line through the soft tissues with a diathermy needle. By slight retraction applied to the sides of the opening into the larynx, the growth can be inspected and its anterior limits ascertained.

Jackson and Norris [28] describe the various types of treatment which they use for carcinoma of the larynx, detailing their technics of laryngofissure and laryngectomy. In 148 cases in which laryngofissure was performed by these authors, there were no deaths. No deaths occurred in the last 70 cases in which they had performed laryngectomy at the time of their report. They review 150 cases of cancer of the larynx in which the patients were treated at Temple University Hospital by operation and irradiation during the period from 1930 to 1937. The five year survival rate in these cases was 64 per cent. In 59 cases in which laryngofissure was performed, the five year survival rate was 80 per cent.

TUMORS OF THE ESOPHAGUS

Boros [29] analyzes the various forms of treatment used in 332 cases of carcinoma of the esophagus occurring in the New York City Cancer Institute Hospital from 1922 to 1944. Results following use of roentgen rays and radium were for the most part unsatisfactory. Study showed no diminution in the size of the tumors, and the author expresses doubt that there has been any prolongation of life. Operation was performed

26. Snitman, M. F.: Carcinoma of the Larynx: Significance of Histopathologic Study of Serial Sections; Preliminary Report, Arch. Otolaryng. **42**:178-185 (Sept.) 1945.

27. Patterson, N.: Treatment of Carcinoma of the Vocal Lip by Operation, J. Laryng. & Otol. **59**:431-433 (Nov.) 1944.

28. Jackson, C. L., and Norris, C. M.: Surgical Treatment of Cancer of the Larynx, Laryngoscope **55**:196-215 (May) 1945.

29. Boros, E.: Carcinoma of the Esophagus, Gastroenterology **5**:106-111 (Aug.) 1945.

in 7 cases with a view to total extirpation of the malignant mass, but the lesions were found to be inoperable. Gastrostomy was performed in 168 cases; relief in swallowing and prolongation of life were experienced by some patients, but not by others. The mortality rate of the operation was high (25 per cent), and it is questionable how much benefit was obtained by the patients who survived. It appears that, in spite of all measures so far devised, carcinoma of the esophagus is practically always fatal and the results of operation are almost uniformly bad.

In 2, or 1.08 per cent, of 185 cases of esophageal diverticula in which operation was performed at the Lahey Clinic, carcinoma developed subsequently. This incidence of carcinoma in cases of diverticulum of the esophagus is much greater than the incidence of esophageal carcinoma in the general population. Hoover,[30] who has made this survey, expresses the opinion that the chronic irritation and inflammation associated with diverticula of considerable size must be considered a predisposing factor.

The Mayo Clinic.

30. Hoover, W. B.: Carcinoma Associated with Esophageal Diverticulum: Report of a Case, S. Clin. North America **25**:707-712 (June) 1945.

Abstracts from Current Literature

Ear

HEARING IMPAIRMENT DUE TO CRANIOCEREBRAL TRAUMA. W. E. GROVE, Ann. Otol., Rhin. & Laryng. **56**:264 (June) 1947.

The function of hearing can be damaged by cranial trauma causing fractures, and an impairment of hearing may be found in cases in which there is no evidence of fracture. In experiments in which animals were subjected to trauma insufficient to produce fracture, hemorrhages were observed in the region of the round window and in the basal coil of the cochlea in slightly injured animals. When injury was more severe, the hemorrhages involved both the endolymph and the perilymph, extending sometimes almost to the helicotrema. In some of these animals the round window was torn and hemorrhages were found even in the ampullae and between the fibers of the acoustic nerve. The effect of such a head injury which does not cause fractures may well be designated as concussion of the internal ear, or commotio auris. By analogy and from reports of autopsies one can say that similar conditions may take place in the human ear. The blood which appears in the labyrinth may be absorbed and recovery take place with little or no permanent injury of hearing. On the other hand, the blood may organize and fibrous or fibro-osseous tissue develop, with eventual atrophy and degeneration of the neural elements. In the latter case permanent damage is shown by the loss of hearing.

Grove found among 832 patients who had undergone cranial trauma 228 with traumatically damaged hearing (27.5 per cent). There were 15 with total deafness of the affected ear, 185 with a pure perceptive or with a mixed type of involvement, 16 with pure conduction deafness and 12 in whom an aggravation of preexisting deafness occurred. The findings seemed to indicate that the likelihood of a hearing loss developing after a head injury is, in general, in direct proportion to the age of the patient—the older the patient the greater the likelihood of a loss of hearing. Fracture of the temporal bones does not necessarily mean that there will be an impairment of hearing, as in 10 of 25 cases of a longitudinal fracture and bleeding from the ears, there was no impairment of hearing. This was also true in 34 of 92 cases of unilateral fracture. Impairment of hearing was found in cases with no evidence of fracture.

M. V. MILLER, Philadelphia.

CHANGING PICTURE OF MASTOIDITIS. VON GEORG KEREKES, Pract. oto-rhino-laryng. **9**:138, 1947.

In an analysis of 521 cases of acute mastoiditis in which the mastoid process was operated on between 1930 and 1944, the symptom complex is evaluated. The cases were grouped by five year periods and all cases were discussed particularly in relation to the usual symptoms, the mild complications and the severe complications. The statistics show that the clinical picture of mastoiditis has undergone marked changes, and the symptoms have been so altered that each case must be carefully evaluated. The indications for operation have become extremely obscure, and in consequence extreme care must be exercised so that one is not confused by any masking of symptoms due to chemotherapy.

PERSKY, Philadelphia.

THE ENDAURAL APPROACH TO THE TREATMENT OF CHRONIC OTITIS MEDIA. AUGUSTO LATORE AGUERO, Rev. de otorrinolaring. **7**:57 (June) 1947.

The author favors an endaural approach for mastoidectomy, and in a detailed article he describes the various technics and their modifications. He has used his own method on 38 patients. In most of these he employed Lempert's technic, but in order to avoid slow healing of the wound, he eliminates the first incision of Lempert's technic and thus preserves the skin of the posterior and superior walls of the external meatus. He describes the technic in detail, beginning with the various points of injection of the local anesthetic, following with his method of procedure and concluding with his postoperative results. He believes that the endaural approach has produced excellent results in all his cases. In 2 cases, in which the discharge from the ear continued, he found that the fault rested with an incomplete exenteration of all the infected cells, particularly those in Citelli's angle. The loss of hearing in his cases depends primarily on the preexisting pathologic process.

PERSKY, Philadelphia.

Larynx

TRACHEOTOMY IN BULBAR PARALYSIS. ROBERT E. PRIEST, LAWRENCE R. BOIES and NEILL F. GOLTZ, Ann. Otol., Rhin. & Laryng. **56**:250 (June) 1947.

In the epidemic of poliomyelitis in Minneapolis in 1946 there were 400 patients with the bulbar type of involvement among the 1,830 patients who contracted the disease. Of the 400, 75 were tracheotomized, and 29 of these survived. The authors analyze the observations on these patients and report more fully on 17 who "lived because of tracheotomy." They feel that the effect of anoxia on the central nervous system with damage to the respiratory and circulatory centers is an extremely important consideration and that tracheotomy (1) improves the chance of survival of properly selected "bulbar" patients if done before anoxia has produced significant damage in the central nervous system and (2) if used in conjunction with various means of producing artificial respiration will enable some critically ill patients to survive until natural recovery of damaged neural tissue can occur.

M. V. MILLER, Philadelphia.

CONGENITAL CYSTS OF THE LARYNX. PAUL H. HOLINGER and ERIK P. STEINMANN, Pract. oto-rhino-laryng. **9**:129, 1947.

The authors believe that congenital cysts of the larynx are comparable to laryngoceles except that they differ in degree and embryologically can be considered as malformations formed during the development of Morgagni's ventricle.

PERSKY, Philadelphia.

PENICILLIN IN TREATMENT OF LARYNGEAL DIPHTHERIA. E. VAN WYK and A. P. VAN DER WEY, Nederl. tijdschr. v. geneesk. **90**:1004 (Aug. 17) 1946.

The importance of general and local administration of penicillin in the treatment of diphtheria of the larynx and the lower respiratory passages is stressed. Of 7 patients with descending diphtheria of the larynx treated in this way, only 2 died. Every three hours 1 cc. of isotonic solution of sodium chloride containing penicillin in a weak concentration (500 units per cubic centimeter) was injected into the trachea through a cannula.

VAN CREVELD, Amsterdam, the Netherlands [AM. J. DIS. CHILD.].

Nose

THE THYROID AND THE NOSE. ARTHUR W. PROETZ, Ann. Otol., Rhin. & Laryng. **56**:328 (June) 1947.

Proetz surveys 84 cases of nasal involvement associated with hypothyroidism and offers the following observations:

1. Deficiency of "the thyroid hormone" (thyroxine) may result in changes of the nasal mucosa which can be recognized as such.

2. These changes are of two types: (*a*) red, dry, irritated, "chapped" or desquamative and (*b*) pale and boggy.

3. Patients deficient in thyroxine may have an increased tendency to nasal infection and nasal allergy, and this tendency can be corrected by administration of thyroxin or thyroid U. S. P. alone.

4. Headache and nasal obstruction are prominent symptoms.

5. The basal metabolic rate is helpful but not infallible in distinguishing cases suitable for treatment with thyroid or thyroxin U. S. P. Five patients of the 37 who showed improvement had rates between minus 10 and minus 3, and 1 had a rate of plus 3.

6. The basal metabolic rate is not a reliable prognostic index. The 4 patients showing the greatest improvement had basal rates of minus 4, 9, 11 and 34 (later, minus 12). In all cases the response of the patient was considered more useful than the metabolic rate in determining the most effective dosage of the drug.

M. V. MILLER, Philadelphia.

ETHMOIDITIS IN CHILDREN. JUAN CARLOS MUNYO, Ann. de oto-rhino-laring. (pt. 2) **17**:39, 1947.

Munyo discusses the problem of ethmoiditis occurring in children. He stresses the pathologic aspects, the incidence, some of the causative factors and the symptoms. Treatment is almost always conservative. Local treatment of the nose, parenteral administration of sulfonamide drugs, antibiotics and vaccines in the chronic cases are all included in his description of methods of combating this infection. If treatment is instituted early, intensively and with the proper evaluation of impending complications, the latter do not occur. PERSKY, Philadelphia.

Miscellaneous

AGRANULOCYTOSIS IN CHILDHOOD: REPORT OF A CASE WITH SERIAL BONE MARROW STUDIES. ERIKA BRUCK, Am. J. Dis. Child. **73**:186 (Feb.) 1947.

Bruck reports recovery in a child of 2 years. The otolaryngologic symptoms were: ". . . ear drums pink and dull, profuse mucoid discharge from the nose, lips cracked, covered with bloody crusts, mouth red, pharynx full of mucus, tonsils moderately enlarged. Cause unknown."

The granulocytes in the blood varied between 0 and 84 per cubic millimeter for eleven days. Six examinations of marrow taken from the sternum and the tibia were made. At the height of the disease hypoplastic bone marrow with "lymphocytic reaction" was found. Symptoms at onset were malaise and fever. Necrotic lesions of the mucous membranes were present at a later stage. A "fall of leucocytes and absence of granulocytes" also were observed later. There were prostration, lobar pneumonia of the left lung and a recurrent erythematous rash.

Penicillin, blood transfusions, crude liver extract and small doses of pentnucleotide were administered. The observation is made that if the bone marrow in these cases is not completely destroyed at the first impact, recovery may take place, provided a concomitant infection does not overwhelm the body defenses.

VOORHEES, New York.

PREOPERATIVE AND POSTOPERATIVE MEDICAL THERAPEUTICS. M. S. ERSNER and M. ALEXANDER, Eye, Ear, Nose & Throat Monthly **26**:23 (Jan.) 1947.

In a series of 200 cases of rhinoplasty vitamin K and ascorbic acid (vitamin C) were used routinely. The incidence of primary bleeding is thereby reduced, and late secondary hemorrhage is not encountered. The incidence of ecchymosis and conjunctival hemorrhage is greatly minimized, and wound healing is aided.

When hypothyroidism has been established or is suspected, the administration of thyroid extract serves the purpose of aiding in the reduction of sodium chloride metabolism, thus hastening elimination of water and helping to reduce tissue edema.

Sulfadiazine was given routinely, and no case of slough or infection was encountered.

There were no toxic or deleterious effects of these drugs in any of these cases.

JENNES, Waterbury, Conn.

REHABILITATION OF APHASICS IN AN ARMY HOSPITAL. VIVIAN MOWAT SHEEHAN, J. Speech Disorders **11**:149, 1946.

The program of the rehabilitation of aphasic patients which is carried on at the Percy Jones General Hospital in Battle Creek, Mich., is described. Communication is damaged in the patients, and many simple problems are involved, which become gradually of great worry to these patients. They soon become aware that they can no longer do many simple things the doing of which they once took for granted. Usually their faults in reading and writing are blamed on paralysis affecting other functions. More serious difficulties arise from the reduction of the capacity for abstract thinking, from the defects of memory, from the shortening of the span of attention, from the lack of ability to concentrate and from the general impairment of intellectual functions. Tension, need for rest and sleep, anxieties and an almost complete lack of the sense of humor make the whole problem extremely difficult. Group work is stressed as valuable since, although this is less efficient, the patients inspire each other. Most aphasic persons are quite confused as to left and right. The vocabulary has to be built in an organized manner. Imitation is vitally important, but all possible approaches must be used. Metal letters arranged on a black table are valuable in teaching reading and spelling. The "sound mirror" is a useful bit of equipment. Basic English is helpful in aiding the patient to get adequate expression without having to learn too large a vocabulary. Writing, arithmetic, group singing, typing, mathematics and any other subject may be used to help the patient along. Speech and language training are coordinated with occupational therapy and physical therapy. The patient is constantly educated as to what aphasia is and what the prospects are for him. A bulletin describing aphasia, published by the University of Michigan Speech Clinic, is sent to the parents and all relatives of the patient. Some of the results are measurable; others simply show in the healthier and happier attitudes of those who live in the clinic.

PALMER, Wichita, Kan.

INDICES OF ACHIEVEMENT IN VOICE INSTRUCTION. FRANKLIN H. KNOWER and MARJORIE EMERSON, J. Speech Disorders **11**:159, 1946.

Four groups of students were studied, numbering 17, 15 (the controls), 11 and 13, respectively. All were students of McKinley High School, Cedar Rapids, Iowa. Groups 1 and 2 were given a test of ability to use tonal symbols communicating emotional moods and meanings and were asked to read a short passage, the reading of which normally required 1.5 to 2 minutes, from Mark Twain's "The Oldest Inhabitant." Skilled college speakers received scores of 80 to 95 per cent intelligibility on these tests. Groups 3 and 4 were tested completely by recording of material. The conclusions were as follows: 1. The intelligibility test of tonal symbolism provides a practical test of achievement in the use of voice in speech instruction. 2. Recordings of a short sample of oral reading are useful in providing an index of achievement in voice usage. 3. Ratings of speech achievement of single trained but independent judges, although highly variable, are on the average higher than ratings of more generalized achievement in speech. 4. The rating-rerating reliability of single judges was about the same as inter-rater reliability. 5. The use of paired comparisons will reveal improvement not recognized when a single standard of judging records of achievement is employed. 6. Voice improvement of far greater significance may be expected from a unit of concentrated instruction than from incidental voice instruction in a general speech unit. The students were not told that they were to be retested. Group 1 received instruction in emotional meanings and special individual instruction in the whole material. Group 2 (the controls) was given simple work in informal speech activities. All of groups 1, 2, 3 and 4 were retested six weeks later.

PALMER, Wichita, Kan.

PARENTAL MALADJUSTMENT AND FUNCTIONAL ARTICULATORY DEFECTS IN CHILDREN. KENNETH SCOTT WOOD, J. Speech Disorders **11**:255, 1946.

Fifty pairs of parents were selected who had children with defects of the articulatory type not assignable to low mentality, loss of hearing or organic malformations. These parents were normal in intelligence, hearing and speech. The California test of personality and the Bernreuter personality inventory were given to all 100 parents, and the scores were compared statistically with the test norms; the speech-defective children were given the California test of personality and Pintner's aspects of personality test. Some of the children were given the Murray thematic apperception test. Two clinical groups were established on the basis of paired neurotic tendency ratings of the mothers, and a program of parental counseling was carried on in one group in addition to treatment of the children. The results were as follows: 1. Maternal scores on the Bernreuter inventory differed significantly from the test norms, showing that mothers of speech-defective children were more neurotic in tendency, more submissive and more self conscious. The scores of fathers did not differ. 2. No correlation was found between the personality test scores of children and those of their parents. 3. Of the group of 50 speech-defective children, 72 per cent had at least one parent above the sixtieth percentile in neurotic tendency, and 64 per cent had at least one parent above the seventieth percentile. 4. Maternal scores on the California test of personality differed significantly from the test norms, indicating that mothers were lower in self adjustment. Fathers rated lower than the test norms in self adjustment. 5. Of the group of 50 speech-defective children, 86 per cent had one parent or parents who were below the thirty-fifth percentile in self adjustment, and 64 per cent had one parent or parents who were below the thirty-fifth percentile in social adjustment. 6. Social standards of

mothers were found to be high in comparison with other adjustment scores. 7. The scores of speech-defective children did not differ significantly from the test norms. As a group they seemed better adjusted than either the mothers or the fathers. 8. The results of the thematic apperception test administered to about 25 per cent showed a sense of frustration, withdrawing and lack of affection, anxiety-insecurity, lack of belongingness, achievement, aggressiveness, hostility and escape. 9. The case histories, obtained for the most part from the mothers, revealed thirteen salient factors in home environment. Most frequent factors were lack of recreational outlet, ignorance of child behavior problems, overly severe methods of discipline and defective home membership. 10. When the mothers themselves were clinically treated for the alleviation of their own problems, their children improved more rapidly than did those of the control group. 11. Functional articulatory defects of children are associated with maladjustment and undesirable traits on the part of the parents.

PALMER, Wichita, Kan.

SEX DIFFERENCES IN RELATION TO STUTTERING. HILDRED SCHUELL, J. Speech Disorders **11**:277, 1946.

The author reviews the literature on sex differences, emphasizing the many differences which exist between the boy and the girl physically, mentally and emotionally, and develops the hypothesis that the boy, whose physical, social and language development proceeds at a slower rate than that of the girl, encounters more unequal competition and, consequently, undergoes more frustrations, particularly in relation to language situations, than the girl; that as a result he exhibits more insecurity, more hesitancy, more inhibitions in speech. This hypothesis will have to be tested by more comprehensive studies than any so far made of stuttering. The insecurities, anxieties and tensions in our culture appear to be increased by the contradictory attitudes prevalent toward the boy in that he is expected to exhibit independence, fearlessness and aggressiveness and at the same time be submissive, orderly, obedient and self controlled.

PALMER, Wichita, Kan.

SPEECH DISORDERS IN WORLD WAR II: VIII. STUTTERING. WILLIAM G. PEACHER and WILLIAM E. HARRIS, J. Speech Disorders **11**:303, 1946.

The authors review such material as is available on stuttering as it was observed in the armed forces. The Army was apparently justified in inducting stutterers. The men observed have generally made a good adjustment and have served their country well in combat zones, communication zones and zone of interior assignments. Many of them would have profited by speech training as demonstrated in this paper, if it had been practicable for the Army to provide such instruction. Should the policy of universal military duty be inaugurated in this country, it is suggested that a more adequate standardized test service for speech defectives be organized by the Surgeon General and that stutterers and persons whose speech is otherwise defective who are capable of military service be sent to special centers where speech correction would be provided on a systematic basis.

PALMER, Wichita, Kan.

TESTING AND CORRECTING CLEFT PALATE SPEECH. MARY WOOTTON MASLAND, J. Speech Disorders **11**:309, 1946.

The author reviews work with patients with cleft palate carried on at Children's Memorial Hospital of Montreal, Canada, for a year and a half. 1. A word test, designed to discover those consonants during the articulation of which nasal escape

occurs, was given to 25 such patients and 10 normal adults. 2. The nasal escape of air when the patient with cleft palate performed this test was demonstrated by the movement of a lever connected with the tambour of a pneumoscope. 3. The efforts of the patient to reduce or eliminate the nasal escape of air were consistently more successful when visual indication of success or failure was provided by the pneumoscope. 4. Simultaneous kymographic records of air pressure changes in the mouth and the nose, respectively, during articulation of the test words provided objective evidence which was used for analyzing the speech defects of the patient. 5. Similar kymographic records were made at intervals during the course of speech training, and the number of consonants during the articulation of which nasal escape of air occurred was used as a measure of progress. Four illustrative cases are presented.

PALMER, Wichita, Kan.

PARAGNOSIA AND PARAPHASIA. MARY HUBER, J. Speech Disorders **11**:321, 1946.

Phonetic analysis of patients with paragnosia and paraphasia produces the following conclusions: 1. It seems unlikely that for dysphasic persons as a group there are actually any particular vowel sounds that consistently present more difficulty than others; however, both pure vowels and diphthongs which represent names of letters of the alphabet, hence more meaningful symbols, may be more easily perceived and initiated by some. 2. Vowel sounds presented in isolation cause less difficulty either in perception or in initiation than consonants. 3. Four patients out of 6 experienced slightly less difficulty either in perception or in initiation of surd consonants than sonant consonants when these were presented in isolation. 4. Whether one syllable words including only sonant consonants present more or less difficulty than vowels or consonants presented in isolation appears to depend on (*a*) whether the receptive dysphasia is largely a difficulty of perception or of comprehension and (*b*) the subject's attitude as set in the testing situation. 5. For receptive dysphasic persons as a group, one and two syllable words including surd consonants represent greater difficulty either in perception or in initiation than one and two syllable words including only sonant consonants. 6. Bilabial surd and sonant consonants appear to represent less difficulty either in perception or in initiation than other consonants. 7. The phenomena of perseveration and association interference appear to complicate the problem of differentiation. 8. Perseveration, or some disturbance related to it, appears to be one of the concomitant factors which combine to produce the symptoms of paragnosia and paraphasia.

PALMER, Wichita, Kan.

PUBLIC HEALTH ASPECTS OF RHEUMATIC FEVER. ALBERT D. KAISER, New York State J. Med. **47**:259 (Feb. 1) 1947.

Kaiser's paper, read at the annual meeting of the Medical Society of the State of New York on May 1, 1946, is of interest to otolaryngologists because of its implication of the group A hemolytic streptococcus. Relative lack of immunity to this germ plus an acute infection of the respiratory tract and some evidence that "recurrences of rheumatic fever can be prevented . . . by prolonged administration of small doses of sulfanilamide" are to be considered. Further, "comparative clinical data on rheumatic fever and streptococcus infections run a close parallel." In World War II epidemics of rheumatic fever were closely associated with infections of the upper respiratory tract in the presence of hemolytic streptococci. Kaiser states, guardedly, that "hemolytic streptococcus infections have something to do with rheumatic fever."

In the discussion, Dr. J. G. Fred Hiss, of Syracuse, N. Y., said that food has little to do with the causation. Neither has urban or suburban residence. He supported the opinion of Dr. May Wilson that two factors are present: one within the patient (predisposition or lack of immunity) and infection, possibly streptococcic. Treatment directed against the streptococci was not emphasized—"rest is at present the best treatment." Education and vocational guidance are recommended, but it is not stated how these can prevent the ravages of a virulent, organ-destroying disease which leaves many cardiac cripples in its wake. To the ear, nose and throat specialist, it is hard to understand why internists are so loath to accept the findings of the bacteriologist.

VOORHEES, New York.

STATUS THYMUS LYMPHATICUS. MARCOS COHN B., Rev. de otorrino-laring. **7**:1 (March) 1947.

Cohn presents a series of 3 patients who died suddenly during the course of surgical treatment. Tonsillectomy was to be performed on 2 of them, and the third was to have a nasopharyngeal fibrohemangioma removed. Each of the 3 patients died shortly after the administration of the local anesthetic and prior to the surgical operation. The anesthetic employed was 20 cc. of 1 per cent procaine hydrochloride solution containing 10 drops of a 1:1,000 epinephrine hydrochloride solution.

In each of the 3 cases the postmortem examination revealed a persistent thymus, greatly hypertrophied lymphatic tissue in the Waldeyer tonsillar ring, and greatly hypertrophied lymph nodes and Peyer's patches in the intestinal tract.

Cohn attempts to establish a typical thymic syndrome. This is characterized by persistence of the thymus, generalized hypertrophy and hyperplasia of all the lymphatic tissue and poor development of the suprarenal cortex and the sexual glands; the skin is usually pale and smooth, with abundant fatty tissue; the hair is usually sparse; the musculature, flaccid, with a tendency to weakness. Status lymphaticus does not invariably depend on the presence of an enlarged thymus. On the other hand, the mere presence of an enlarged thymus does not necessarily indicate that the patient has status thymus lymphaticus. The cause of this condition is a moot question. It is claimed to be due either to an endocrine dysfunction or to a deficiency of the suprarenal cortex, which in turn causes hyperplasia of the thyroid gland and of the liver and a pancreatic hormonal deficiency. It is also an open question whether or not the status thymus lymphaticus constitution is a cause of sudden death; but since there are a number of these cases, the surgeon must realize that persons having this type of constitution present a greater surgical risk.

PERSKY, Philadelphia.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

John R. Lindsay, M.D., President

Lawrence J. Lawson, M.D., Secretary

Regular Monthly Meeting, Feb. 2, 1948

Introduction. Dr. Francis L. Lederer.

The governmental agencies concerned with veterans' hospitals are of particular interest to the physicians who practice the various specialties. Since the advent of the activities of the Deans' Committee, my colleagues and I have been engaged in organizing the services at the Veterans Administration Hospital, at Hines, Ill. The hospital has a total bed capacity of 1,795, and the Vaughn Unit a total bed capacity of 1,500. We have seven residents, one senior consultant and five attending otolaryngologists, and our patients occupy 52 beds for the general otolaryngologic service and 50 beds for treatment of tumors of the head and the neck. One attending otolaryngologist is employed on a full time and the others on a half time basis. The senior consultant examines patients especially selected for his observation and makes weekly grand ward rounds with the entire staff.

During the past year the department of otolaryngology of the hospital has given 2,563 patients what are known as "P-10" examinations to decide on admissibility. The patients examined, observed or treated by the attending staff totaled 7,632.

From the year 1938 up to and including 1946 the eye, ear, nose and throat services were combined. In 1947 the eye service was separated; in that year there were 300 eye and 1,558 ear, nose and throat procedures, the latter including every form of mastoidectomy, bronchoscopic and esophagoscopic procedures, nasal plastic surgery, submucous resection, tonsillectomy, removal of submaxillary glands, laryngofissure, laryngectomy, sinus operations, frontal bone operations and procedures dealing with all forms of cervical infection.

The resident staff consists of men who have completed their basic training in otolaryngology. This residency, therefore, constitutes their second year in the specialty. At this time the residency is limited to one year, but it is contemplated that in 1949 it will be extended to two years. The work of residents is supervised by attending men who are all members of the faculty of the University of Illinois. There are numerous conferences, otolaryngologic, general resident, tumor and departmental. In addition, these residents are included in the residency training program under the supervision of the University of Illinois. They participate actively in seminars at the university, the otolaryngologic forum at the Illinois Eye and Ear Infirmary, and in special lecture series arranged in the evening for their convenience.

Intranasal Extension of Pituitary Tumors. Presented by Dr. Stanton A. Friedberg.

Certain intracranial tumors involving the region of the sella turcica are known to invade the sphenoid sinuses, the nasopharynx and the nasal passages by direct extension. The most common of these are pituitary adenoma and chordoma.

The Scientific program was presented by the University of Illinois representatives to the Veterans' Hospital, Hines, Ill.

The case histories of 3 patients were presented. In each instance the diagnosis of the specific intracranial lesion was made on microscopic examination of tissue ("polyps") removed from the nasal cavity. Two of the patients had typical malignant chromophobe adenoma of the pituitary gland. The third patient was found to have chordoma of the spheno-occipital type.

Headache, nasal obstruction and excessive postnasal secretion are probably the most common symptoms encountered by the otolaryngologist. Their significance becomes increasingly important with the realization that these same symptoms may be associated with the extracranial extension of sellar neoplasms.

Every patient known or suspected of having a lesion of the anterior or middle cranial fossa should have a careful nasopharyngeal examination, this study to encompass the utilization of all available diagnostic aids. Lateral views of the sphenoid sinuses and the sella turcica should be included in routine roentgenograms of the nasal accessory sinuses. The necessity for microscopic study of all nasal polyps is again emphasized.

DISCUSSION

DR. THOMAS C. GALLOWAY: Why did you not operate in the second case transseptally by the method of Hirsch or by Clicari's technic?

DR. JOHN R. LINDSAY: I recall 3 cases in which pituitary tumor extended downward into the nose. In the first one the tumor advanced in the septum halfway to the vestibule; in the second and third the nasopharynx was blocked. One patient, I believe, is living and well today, twelve years after roentgen ray therapy. Another was treated about eight years ago by means of radiation and was living several months ago. The third, for whom my associates and I recommended high voltage roentgen radiation but who was treated by implantation of radon, died of hemorrhage. In these 3 cases the tumor was diagnosed as chromophobic adenoma on biopsy.

DR. STANTON A. FRIEDBERG: In reply to Dr. Galloway's question regarding an intranasal approach, there were two reasons why this was not done: In the first place, the patient was on the neurologic service. A second consideration concerned the areas involved and the mortality rate for the surgical treatment of extensive malignant pituitary adenoma, as pointed out by Jefferson. This author reported that there was 33 per cent operative mortality among patients with extrasellar tumor spread. This patient's lesion had extended into the left periorbital space as well as through the floor of the right sphenoid sinus.

Concerning Dr. Lindsay's comment: Irradiation is advocated by most writers for pituitary adenoma which has spread extracranially. One of our patients thus treated lived for four years after the diagnosis of intranasal extension was established. The outcome in the cases described by Dr. Lindsay would seem to bear out further the efficacy of this method.

The case history of the patient with the chordoma is interesting. It was possible to remove large masses of chordomatous tissue from the nasal cavity on four occasions over a period of eighteen months. This was done with coagulating diathermy because of the extreme vascularity of the tumor and resulted in marked relief from distressing nasal obstruction. After the last operation the tumor seemed to grow much more rapidly. Necropsy some months later showed the tumor extending along the entire basal plate of the skull and into all the paranasal sinuses.

The Posterior Lateral Approach to the Larynx for Bilateral Recurrent Paralysis of the Vocal Cord. Presented by DR. ROBERT B. LEWY.

The greatest step forward in surgery designed to move one vocal cord laterally in order that the airway may be increased was accomplished not long ago by Dr. Brien King. It was his concept that orthopedic principles be applied and that the arytenoid cartilage be pulled laterally by the action of the transplanted and affixed omohyoid muscle. However, the results of this technic were unsatisfactory in the hands of other surgeons. The principle remained. Thus it was that Dr. Kelly modified this approach and found the arytenoid cartilage by making a window in the posterior third of the thyroid ala. He then transplanted the cartilage laterally. This has met with considerable success and is still the method of choice of most laryngeal surgeons. The operation still left a good deal to be desired in that there was a considerable percentage of failures; it was in a sense destructive as some cartilage had to be sacrificed, and, in addition, the operation was not anatomic. Instead of following tissue planes, direct access was accomplished by transecting the thyroarytenoid and cricoarytenoid lateralis muscles. This was not easy, and therefore attempts were made to find a more anatomic and less destructive approach.

The approach developed by Woodman (and herein reported) is a more posterior one. Incision is just anterior to the sternocleidomastoid muscle; dissection is then carried down plane by plane until the posterior margin of the thyroid cartilage is exposed. On the most posterior border of the ala an incision is made through the perichondrium, and this is elevated anteriorly and posteriorly. The articular facet (the main landmark) of the cricothyroid joint is found, and the cartilages are separated with an elevator. The incision is then carried through the posterior portion of the perichondrium, and the arytenoid structure is exposed. A slit is made in its perichondrium, and the arytenoid cartilage proper is exposed. This is then removed with a punch-biting forceps down to the vocal process. A stitch is placed which goes through the vocal process and part of the vocalis muscle. This is drawn around the inferior cornu of the thyroid cartilage and drawn up, thus pulling over the vocal process and the vocal cord in a manner similar to pulling a boat up to a dock. The stitch is then anchored in the sternocleidomastoid muscle. Closure is by layers; no. 0 chromic catgut is used; the needle is a cutting one, half-inch, half-curved in shape.

REPORT OF A CASE

A 33 year old white man was admitted to the Veterans Administration Hospital at Hines, Ill., on July 8, 1947. He complained that he had experienced a loss of 50 to 60 pounds (22.5 to 27 Kg.) in one year, difficulty in breathing for six to nine months and twitching and cramps of the legs and the arms for a year. He had undergone thyroidectomy in March 1946, with severe respiratory difficulty requiring oxygen immediately following the operation. He was unable to speak above a whisper for several months postoperatively. He also had difficulty in swallowing. These symptoms grew progressively worse until he sought hospital care.

Physical examination gave negative results except for a thyroidectomy scar and slight exophthalmos. The blood calcium was 8.6 mg. per hundred cubic centimeters. The red blood cell count was 2,900,000. The basal metabolic rate was minus 5. An electrocardiogram showed an increase of the Q-T interval. Roentgen studies of the tibia and the skull showed them to be normal. Laryngeal examination revealed bilateral paralysis of the vocal cords. Shortly afterward tracheotomy was done, and in the succeeding weeks the patient gained 20 pounds (9 Kg.). On Septem-

ber 17 the King operation as modified by Woodman was performed, and the postoperative course was uneventful. During this time the blood calcium remained stabilized on a dosage of 10 Gm. of calcium lactate daily. Since the operation he has gained more weight; stridor, dyspnea and dysphagia have disappeared. The airway by indirect view is now adequate, and he has returned to his previous occupation of automobile mechanic, which his preoperative condition had made impossible.

(Slides were shown demonstrating the technic of the operation.)

While this seems a logical approach to the solution of this problem and in this instance was successful, it was by no means easy. The process of getting down to the posterior ala of the thyroid cartilage is a painstaking one, and it was discovered that the long way around is the shortest way home. There is no doubt in my mind that dissection by layers is quicker and neater than the direct approach which was attempted.

One was reminded of the danger of working in this region when cardiac arrest developed in the patient. Fortunately, it proved temporary, but it indicated the advantage of injecting procaine hydrochloride locally over the region of the carotid sinus when this may be stretched or compressed. It was not easy to expose the arytenoid structure. Constant and marked tension from the edge of the thyroid cartilage upward was required, and the surgeon had to work under a canopy formed by the lateral wing of the thyroid cartilage. Placement of the needle was also difficult; correct placement determines the success or the failure of the procedure. It may prove of value to reverse the course of the needle so that none of the placement will be blind.

Despite these difficulties it is believed that the operation is an improvement over the King procedure. Further testing by a number of surgeons and comparing of results will be necessary to establish this point.

DISCUSSION

DR. PAUL HOLINGER: The approach that has been described is excellent. A new suggestion made by King adds to opening of the airway. He puts a large knot on the suture and as he brings the suture through the arytenoid cartilage, the knot has a tendency to bring the arytenoid structure outward instead of tumbling it in. I believe this improves the airway by rotating the arytenoid cartilage into position. I think the suggestion of Galloway and Seed, namely, to remove a portion of the posterior border of the thyroid ala, is excellent, and I wonder if Dr. Galloway will comment on this technic.

DR. MAURICE SNITMAN: At a meeting of this society several years ago, Dr. Galloway outlined the transthyroid approach. We have carried out this procedure in 3 cases and obtained satisfactory results in 2, where the arytenoid cartilage was displaced but not removed.

DR. THOMAS C. GALLOWAY: Dr. Seed and I saw no point in taking out the arytenoid cartilage. It is an advantage if you have a window in the thyroid cartilage, to have something to fill the space; and I wonder what the advantage is in removing it as Kelly and King have done. It serves as a guy to hold the vocal cord out. It is of course important that attachments of the cricoarytenoid articulation be completely freed.

DR. JOHN R. LINDSAY: Has any one had the experience of obtaining too wide an airway? I have had a case in which, following arytenoidectomy, the patient has more airway than she needs for comfortable respiration. She has air loss in speaking. The arytenoid cartilage was removed and the cord retracted laterally

by means of a suture passed through it at the point at which it is attached to the vocal process.

DR. ROBERT B. LEWY: I do not know that I can give a truly competent answer to Dr. Galloway as to why the arytenoid cartilage should be removed. I think, however, that if it were not removed in using this technic one would fail in the desired result. Without separation of the cricoarytenoid joint one would fail.

As to the problem of the too wide airway, I was extremely cautious about that; I did my best to control the situation by laryngoscope in the patient's mouth and direct observation; I looked in when the knot was tied. The usual failure occurs when the cord does not extend laterally far enough. Then the surgeon may feel it would be desirable to operate on the opposite side as well. This particular difficulty arises much more frequently than the problem of getting too wide an airway. In the patient in the case reported, for a while after operation it seemed that the airway was not adequate. It was not until five weeks later that I was satisfied that I had accomplished what I started out to do.

Clinically Malignant Tumors in Otolaryngology. Presented by MAURICE F. SNITMAN.

"Malignant" is not a synonym for "cancerous." It refers to the harmful effects of any tumor, whether that tumor histologically is benign or malignant. There is, fortunately, an increasing tendency to restrict the term "malignant" to new growths that are essentially deleterious to the host. The important features of such growths are infiltration, local destructive properties, recurrence after incomplete removal, interference with function and general toxic action of the absorbed tumor products. Tumors classified as benign possess almost all these features, and this fact is not sufficiently appreciated.

Neoplasms such as nasopharyngeal fibroma, nasal papilloma and chondroma present problems of therapy whose magnitude is comparable to that of the problems of therapy of carcinoma and sarcoma. With inadequate treatment such lesions will frequently prove fatal.

A not uncommon lesion is the salivary gland tumor. This designation does not fully imply the true malignant potentialities of the growth, and the need for radical therapy is not generally appreciated. It has been my experience that clinically malignant tumors that do not bear the label of carcinoma or sarcoma do not receive the serious consideration they merit.

I wish to present 3 cases that in some measure bear out these points:

CASE 1.—H. R., a man aged 39, was first seen by an otolaryngologist in April 1943, because of nasal obstruction. This was caused by a tumor in the floor of the left side of the nose. Biopsy showed chondroma. Local surgical resection was performed, which proved inadequate. In December 1943 roentgen studies showed the hard palate to be eroded. Between 1943 and the latter part of 1947 the patient underwent several surgical procedures, which again proved inadequate. In October 1947 examination at the Research and Educational Hospitals of the University of Illinois disclosed extensive destruction of the left upper maxilla with involvement of the orbital floor and pterygopalatine fossa. Radical resection was attempted, but the lesion was found to be too extensive for safe surgical intervention.

CASE 2.—G. B., a man aged 65, was examined in August 1947 at the Veterans Administration Hospital at Hines, Ill., and found to have both sides of the nose filled with polypoid tissue; in the glabellar region there was a fistula about 2 by 3 cm. in diameter, which led into the frontal sinus and was filled with polypoid

tissue similar to that in the nose. He had first experienced obstruction of the right side of his nose in 1934. The polyp was removed, and biopsy disclosed a precancerous or carcinomatous degeneration. Radical antrotomy was performed on the right side, and subsequently he underwent antranasal polypectomy 24 times. In 1939 external frontal sinusotomy was performed; after healing, the area of the operative site broke down and produced a fistula. Because of the extension of the lesion, a radical exposure of the frontal area was then performed and the tumor destroyed by electrocoagulation. The cribriform area of both sides has been entirely destroyed, but the dural surface of the anterior fossa of the skull is well protected by scar tissue formation. Electrocoagulation of residual tumor has recently been performed, and on the last examination there appeared to be only small remnants of neoplastic tissue.

CASE 3.—H. W., a man aged 54, complained, in February 1943, of nasal obstruction. Examination showed a tumor filling the right nasal cavity; biopsy revealed a salivary gland tumor of the basaloma type. Surgical removal was refused, and a course of roentgen ray therapy was given over the next few years, with resultant regression of the tumor. The patient was not seen thereafter until February 1947; at this time he complained of enlargement of the tip of the nose and shortness of breath associated with cough. Study of the chest showed both lung fields extensively involved by metastases.

From the foregoing cases it appears that most benign tumors of the head and the neck, although they do not bear the terms "carcinoma" and "sarcoma," merit efforts of therapy commensurate with those used in cases of carcinoma and sarcoma. Most histologically benign tumors, if inadequately treated, will, in many instances, prove fatal.

The Otologic Effects of Streptomycin Therapy. Presented by DR. LINDEN J. WALLNER.

Aural examinations were made of 93 patients receiving streptomycin at the Veterans Administration Hospital at Hines, Ill. They are divided into two groups according to dosage. Group 1 received 2 Gm. each twenty-four hours for four months. Group 2 received 1 Gm. a day. Audiograms and caloric tests were made before, during and after treatment.

One patient with anuria suffered almost total loss of hearing; no other patient was found to have any impairment of hearing from the drug.

Of the 53 patients in group 1, 42 noticed subjective symptoms of dizziness, staggering gait or visual disturbances, and 25 had objective evidence of depression or absence of vestibular function. Of the 40 in group 2, 18 complained of subjective symptoms, and 13 had depression or absence of caloric response. No return of function was noted later in those in whom responses were absent. They also continued to have subjective complaints, trouble on walking in the dark, and dizziness, though these symptoms became less bothersome. These patients were grateful for the improvement in their general condition and did not seem to feel the vestibular disturbances were too high a price to pay for it.

DISCUSSION

DR. SHERMAN SHAPIRO: I think one of the most interesting things about this paper is that there is shown for the first time the effect of something analogous to the experimental exclusion of both vestibular impulses in animals, practiced by McNally and other investigators. However, my idea is that in Dr. Wallner's patients this takes place at a higher level than the internal ear, somewhere in the

central vestibular area. I would be interested to see how long these disturbances last. If one judges from the effects in congenital deafness, there should be sufficient compensation in time for these people to function in a normal way. One thing to know is whether or not there has been any change recently in the method of producing streptomycin. It is not impossible that the toxic effects may be due to impurity in manufacture rather than in the drug itself.

DR. PAUL CAMPBELL: I should like to mention two things. The toxicity of streptomycin seems to be due to the ratio between intake and excretion. In regard to Dr. Wallner's case in which there was anuria, I think it has been proved that in four hours' time the streptomycin level can reach a point at which it can destroy the vestibular apparatus. The internists do not seem to understand what a serious thing loss of the vestibular function is. They seem to think it will soon be compensated for; however, this is not true. I do not think such people could work on a roof or a scaffold; I certainly would not want them on my roof at my responsibility.

DR. JOHN R. LINDSAY: At the meeting of the eastern section of the American Laryngological, Rhinological and Otological Society a report was made that if the dosage of streptomycin was kept below 19 mg. per kilogram of body weight per day, it would not be likely to cause vestibular signs. Yet, according to Dr. Wallner, some patients do get vestibular signs. Dr. Hawkins, of Merck & Company, pointed out that certain animals not only lose the vestibular response subsequent to streptomycin therapy but have loss of optokinetic nystagmus as well, which would indicate more widespread central damage.

DR. LINDEN WALLNER: I cannot answer Dr. Shapiro's question about possible impurities. The patients in this report received the drug over an eighteen month period, so that a number of different batches must have been used.

Subjective complaints were noted in about three weeks, but it was about two months before caloric responses were absent.

Osteomyelitis of the Frontal Bone: Report of Case with Recovery. Presented by DR. HARKISHEN SINGH.

AMERICAN LARYNGOLOGICAL ASSOCIATION

Arthur W. Proetz, M.D., *President*

Louis H. Clerf, *Secretary*

Sixty-Ninth Annual Meeting, Hot Springs, Va., April 14-15, 1948
Abstracted by Samuel Solinger, M.D.

Tonsillectomy in the United States. Presented by DR. L. R. BOIES.

Tonsillectomy is still one of the most frequently performed operations in this country. It therefore merits a discussion from the point of view of its effectiveness. Boies states that the most common indications for the procedure are repeated attacks of acute infection, hypertrophy causing obstruction, and persisting infection. He finds that persistent stumps are more common than is generally believed. In a series of 430 patients he found 135 showing remnants of tonsils. These are dangerous in most cases because they are embedded in scar tissue, which pre-

disposes to the retention of infection. Such stumps require radical removal, and they are not to be confused with enlarged lymphoid follicles. In his experience the lingual tonsil is not the common cause of morbidity. While its removal is generally indicated, one should not assume that this is easy. If removal is to be complete, one has to dissect up to the midline. Dr. Boies makes it a routine to aspirate the tracheal accumulations via a Flagg laryngoscope after each operation. He believes this will do much to prevent postoperative pulmonary complications. As for the question of poliomyelitis, he is not convinced that the operation acts as a predisposing factor.

DISCUSSION

Dr. Burt R. Shurly agreed that the relationship of tonsillectomy to poliomyelitis is much overdrawn. He had never seen a case of such a relationship in an experience of more than 20,000 tonsillectomies. Publicity has done much to instil fear of the operation in the minds of the laity, as a result of which many persons who would be greatly benefited by the operation are denied its benefits.

Dr. John D. Kernan considered the problem an exceedingly important one in view of the fact that around two million tonsillectomies are done in the United States every year. Many questions in this connection are still unanswered, particularly those dealing with the function of the tonsils and the effect of their removal on the general economy. The observation that lymphoid nodules appear throughout the pharynx after the operation leads one to speculate on the biochemistry involved and the possibility of a physiologic demand for this tissue. He expressed the belief that there are many good reasons for doing the operation, but he would like to have them supported by more scientific data than have as yet been available.

Dr. Henry M. Goodyear added to the list of indications given by Dr. Boies mouth breathing, attacks of otitis media and enlarged cervical glands. Also, he said that adenoidectomy should be considered at the same time, since the two are usually done in one sitting. The operation is not a simple one, and general practitioners should be discouraged from doing it. He is opposed to the procedure being done with the head in the extended position, because this interferes with proper visualization of the adenoidal region. It is important that a satisfactory palate retractor be employed so that the adenoids may be removed under direct inspection. As for recurrence of lymphoid tissue, he was convinced that if one administers iodine for a period of time, occasionally with thyroid extract, it will do much to retard this unpleasant phenomenon.

Dr. James M. Robb found, on dissecting a number of rats, that there was no lymphoid tissue in the rat's pharynx. Since this animal lives under most unhygienic surroundings, eating dirty food, it is difficult to understand the absence of this tissue if it has any value in protecting the organism against infection.

Dr. John D. Kernan stated that the pig lives under the most unhygienic conditions, certainly as bad as the rat's, and so far as he knows the animal does possess tonsil tissue.

Dr. L. R. Boies, in closing, stated that it was his understanding that the rat, as well as all mammalians, has tonsils.

Lermoyez' Syndrome—An Allergic Disease. Presented by Dr. W. W. Eagle.

Eagle describes the Lermoyez syndrome as an allergic phenomenon similar to the Ménière symptom complex, except that the symptoms appear in the reverse order. Characteristic of the Lermoyez syndrome are the symptoms due to vaso-

spasm and the early appearance of allergic phenomena, such as urticaria, tinnitus and impairment of hearing, with vertigo as the last to be complained of. As a rule, the recovery is complete, and the deafness does not persist, as it does in Ménière's disease.

DISCUSSION

Dr. Francis L. Weille stated that at a recent staff meeting of the Massachusetts Eye, Ear and Throat Hospital the chief of the allergy service made the statement that he had never seen a case of vertigo in which allergy had played an important role.

Dr. Marvin F. Jones referred to a paper he had published some years ago (Manifestations of Allergy of the Ear, *Ann. Otol., Rhin. & Laryng.* **47**:910, 1938), citing 8 cases in which the connection was definitely proved.

Dr. H. L. Williams recalled the fact that Ménière's original paper reported a series of cases in which deafness was the earliest symptom, often appearing years before the onset of vertigo. Concerning the role of histamine in Ménière's disease, the work of Farmer in New York and others has thoroughly discredited its importance. Neither does he believe that the histamine skin test is of any value so far as diagnosis is concerned.

In Dr. Williams' clinic they see an average of 250 patients a year whose condition has been diagnosed as Ménière's disease or Ménière's syndrome, among whom he has noted only 1 that might possibly be considered as having the Lermoyez syndrome. This was a woman past the menopause, whose audiogram was typical of otosclerosis. Her attacks of vertigo, nystagmus and vomiting were relieved by stilbestrol.

Attention might be called to the fact that asthma, angioedema and such conditions are often not the result of an antigen-antibody reaction but are rather a manifestation of physical allergy. The work of Gottfried, Mueller and others leaves one in doubt as to whether these manifestations are truly those of allergy. It all depends on the definition the particular author wishes to employ.

Dr. W. W. Eagle, in closing, admitted being confused by the history of Ménière's disease, especially in view of the recent interpretations of contemporary investigators. He felt that his presentation of the Lermoyez syndrome might help to separate the doubtful from the true Ménière's disease. He still was of the opinion that it is an allergic disease and he still would consider urticaria as an allergic phenomenon.

The Cross-Sectional Area of the Lower Respiratory Tract at Different Levels and Its Possible Physiologic Significance. Presented by Dr. A. C. Hilding.

Dr. Hilding measured the cross section and the circumference of the secondary bronchi down to the bronchioles, from 0.8 to 1.75 mm. in diameter, in five lungs. Contrary to the theoretic assumption that there is an enormous increase in air volume, the reconstructed measurements indicated an increase of volumetric capacity of only 50 to 100 per cent over that found in the trachea. Furthermore, it was found that the tracheobronchial tree down to the finest bronchioles offers no effective air-conditioning apparatus such as is found in the nose. However, the increase in area of ciliated mucosa down to the smallest bronchioles is something like twenty-five thousand times that of the upper respiratory area, which in itself is of vital importance in the filtration and separation of foreign material. Fifteen to forty thousand bronchioles lined with ciliated mucosa covered with a blanket of sticky mucus is an impressive figure.

DISCUSSION

DR. H. I. LILLIE raised the question as to how the air is conditioned in a patient breathing through a tracheal opening.

DR. THOMAS C. GALLOWAY posed the problem of secretion accumulating in the small bronchioles and alveoli in the presence of respiratory paralysis. Aside from suction and postural drainage, what other mechanism would be available in ridding the passages of this material?

DR. ARTHUR W. PROETZ commented on the fundamental nature of this investigation and predicted that as its import is fully realized its value will be augmented in many practical ways.

DR. A. C. HILDING, in closing, said in reply to Dr. Lillie that the trachea and primary bronchi are not protected, which accounts for the early accumulation of secretion and crusting. However, these are not the essential structures requiring protection. It is the alveoli that need efficient conditioning, because it is here that the vital function of oxygenation takes place. The thing that helps so much is the residual air already conditioned which acts as a cushion against the smaller amount of freshly inhaled air. The latter never goes directly into contact with the alveolar wall but reaches it only on being diffused through the already warmed and moistened residual air.

Replying to Dr. Galloway, Dr. Hilding stated that in respiratory paralysis the cilia themselves are not affected. They act independently of any nervous mechanism. They do function effectively in carrying the secretions up to the major bronchi. The failure to expel the accumulation is due to a mechanical impediment which is the result of the paralysis.

Nerve Distribution of Clinical Significance in Laryngology. Presented by DR. A. C. FURSTENBERG.

Dr. Furstenberg discussed the pathways involved in respiration, coughing, sneezing, hiccup, etc., and showed how these manifestations are affected in various pathologic states. There are two pathways by which respiration may be increased and only one by which it is lowered. The center for the latter is in the postorbital gyrus. Stimulation of this area, which occurs in complications of ethmoid and sphenoid sinusitis, causes a slowing of the respiratory rate which is observed before symptoms of intracranial pressure are manifest. Increased respiratory rate comes late from pressure and irritation in the preoptical brain areas. The cough and hiccup reflexes are similarly delineated. Emotional factors may initiate these reflexes which, when fully understood, will explain those cases in which the symptom persists despite absence of clinical findings. The author further described the incongruous symptom of nasal obstruction complained of by some patients after a well performed submucous resection of the septum. It is probably due to injury of the end organs of the fifth nerve in the mucosa, which affects the reflex arc. In these cases regeneration usually takes place with restoration of the normal sensation.

DISCUSSION

DR. NORTON CANFIELD cited 2 cases in which he hoped a solution to the dilemma might be forthcoming on the basis of Dr. Furstenberg's studies. The problem had to do with 2 infants in whom tracheotomy had to be performed to relieve distress due to respiratory croup with laryngeal infection. Subsequent attempted removal of the tubes always was followed by spasm, which necessitated replacement a number of times. In 1 case it was six months before the child could do without the tube.

Dr. Marvin F. Jones was impressed with Dr. Furstenberg's discussion of the nasal obstruction following resection of the septum, because it brought to mind his own experience of the same complaint in patients with atrophic rhinitis. He was convinced that the break in the reflex arc is due to a degenerative process following either trauma or disease. Disturbance of the reflex arc is only one of the manifestations of the degenerated end organ; one will also find sensation blunted and secretions abnormal. In other words, the membranes are nonfunctioning.

Dr. Chevalier L. Jackson mentioned another instance in which disturbance of a reflex arc was responsible for difficulty in respiration, namely, that of a post-laryngectomy patient who complained of difficulty in getting his breath despite an adequate stoma and absence of significant physical findings. Dr. Jackson wondered whether the difficulty was to be explained on a psychosomatic basis or whether it was truly an interference with the normal reflex arc.

Dr. Harold I. Lillie inquired how one could explain the arrest of sneezing bouts by pressure on the upper lip. In connection with the nasal respiratory arc he had observed atrophy, loss of sensation and impaired nasal breathing following zinc ionization.

Dr. James M. Robb commented on the association of tearing and sneezing. The reflex arc for tearing comes by way of the parasympathetic nerve which arises from the nervus intermedius and passes over the gasserian ganglion, and then over the second division of the fifth nerve and the zygomatic-temporal branch to the lacrimal gland. He asked whether Dr. Furstenberg could connect up the fifth nerve with the reflex arc to explain the association of tearing with sneezing.

Dr. Louis H. Clerf inquired about the reflex arc which would account for sneezing attacks on coming out of a dark room into the sunlight.

Dr. Arthur W. Proetz added an observation of a patient on whom sneezing could be induced by touching the hairline on the side of the head.

Dr. A. C. Furstenberg, in closing, believed that Dr. Canfield's and Dr. Jackson's cases could be explained on the basis of irritation of the tracheal mucous membrane; the reflex arc by way of the recurrent laryngeal nerve through fibers from the vagus nerve to the medulla and then down the spinal cord and to the so-called nucleus ambiguus which furnishes the motor impulses. Stimulation of the mucosa could certainly result in laryngeal spasm. Dr. Jones's observations confirmed his own with regard to nasal obstruction following operation. However, the persistence of the complaint is dependent on the degree of atrophy which, of course, would vary between the extremes of a simple submucous and a well advanced atrophic rhinitis. Concerning Dr. Lillie's inquiry, he believed that sneezing may be stopped by pressure on the upper lip because the pressure causes sufficient pain to stimulate the inspiratory center and halt the attack. Replying to Dr. Robb and Dr. Lillie, Dr. Furstenberg showed a slide in which the connections between the fifth and seventh nerves were shown. Furthermore, it showed how fibers of the seventh pass around the nucleus of the sixth nerve. It is possible that a synapse exists in this area.

Etiology, Treatment and Prevention of Chronic Sinus Infection. Presented by Dr. Samuel J. Crowe.

A virus is the underlying cause of most of the conditions otologists treat in the upper air passages. As a result, the way is paved for pathogenic bacteria to enter into the sinuses, the lymph nodes, the ears, the tonsil crypts, etc. The cavities are shut off by swelling of the lining membranes, and this closure favors the development and propagation of the bacteria. The nasopharynx is frequently the

initial port of infection, particularly by way of the lymphatic elements. It is important, therefore, to see that this tissue is controlled, and up to the present time the best method of achieving conrol is by way of local irradiation.

In acute infection of the frontal sinus the author has had good results from external trephining through the floor of the sinus and instilling penicillin or tyrothricin. In a series of 102 patients 88 had to have this procedure, the remaining 18 recovering under antibiotic therapy.

(There was no discussion.)

Associated Symptomatology of Diseases of the Epipharynx. Presented by Dr. Walter H. Theobald.

Thorough examination of the nasopharynx will often reveal the cause of a variety of symptoms not generally associated with disease of this region. Analysis of 150 cases showed that the most common symptoms reported were postnasal discharge and frequent colds. These were most commonly seen between the ages of 40 and 45. There were 16 cases of dry cough, 6 cases of bleeding, 9 cases of soreness and burning sensation and a number of cases of sore throat with adenitis. Otalgia was a frequent symptom in children. Local findings consisted of lymphoid masses, pharyngeal bursa, carcinoma and tuberculosis. Direct examination of the region with the nasopharyngoscope, or with the mirror, or through the Yankauer speculum or similar devices for exposing the epipharynx is important.

DISCUSSION

Dr. Frederick T. Hill emphasized the value of direct inspection. He has found electrocoagulation useful in attacking lesions in this vicinity, using the Yankauer speculum as the indifferent electrode. In acute epipharyngeal infections it is well to bear in mind the possibility of diphtheria, particularly if the tonsils have been removed.

Dr. Thomas C. Galloway recalled the experience of a former colleague, Dr. Profant, who had cured a man with a disabling arthritis by removing a pharyngeal bursa which had escaped the attention of fifteen otolaryngologists who had previously treated the man. Dr. Galloway is much interested in the question of the importance of lymphoid nodules, being of the impression that they do act as a nidus of infection, often an important one. He has had some success in eliminating these foci by using a punch forceps under direct inspection via a Love retractor. If islands of epithelium are left between the denuded areas, the raw spaces will soon be covered over and extensive scarring prevented. When a bursa is encountered, it can be cured only by operation. Irradiation may be used with caution. There are cases in which the lymphoid tissue reacts by increased growth rather than regression.

Dr. Samuel Salinger found it difficult to examine children directly with the pharyngoscope or palate retractor. He had had success in visualizing the region by anterior rhinoscopy after thorough shrinking of the turbinates. Having been trained to use the Kirstein headlight, he found no difficulty in focusing the light on the nasopharynx through the dilated nasal passages.

Dr. W. H. Theobald, in closing, expressed his satisfaction in clearing up obscure cases of fever and bleeding which had baffllled the internists, by tracing them to a chronic lesion in the epipharynx. Direct examination is the only way in which the entire field can be minutely examined and the furrows, crypts and hyperplasias located and evaluated.

Complications Following Irradiation of the Thyroid Gland. Presented by Dr. N. M. Lukens.

Serious damage of the larynx may ensue as a result of inexpert irradiation of the thyroid gland. Five cases are cited, 1 of which ended fatally. Cough, bloody expectoration, dyspnea and stenosis were the symptoms encountered, due to perichondritis of the laryngeal box. In some of the cases the disturbance lasted several years and necessitated numerous laryngoscopic examinations for removal of granulations, employment of dilators, etc.

DISCUSSION

Dr. Louis H. Clerf recalled having reported similar experiences twenty years ago. He had since then seen additional cases of this type in which the damage done to the overlying soft tissues of the neck resulted in telangiectasis, induration, atrophy, etc. In a patient who had received irradiation twelve years earlier for a benign lesion a postcricoid carcinoma developed. It is therefore possible to encounter a cancer due to the degenerative changes caused by injudicious irradiation.

Radiation therapy for benign lesions should be administered only by the most experienced radiologists who realize its limitations as well as its possible threat to normal tissues.

Dr. Arthur C. Jones reported a case in which fatal ascending myelitis of the spinal cord followed extensive irradiation of the larynx of a girl of 13 for carcinoma. A pathologist who discussed this case when it was reported stated that he had seen 10 cases of ascending myelitis following high voltage irradiation of the cervical region.

Dr. Samuel Salinger, reporting his experience with irradiation for carcinoma of the larynx several years ago, called attention to cases of necrosis and sloughing. More recently he reported a case in which radium applied to a child's neck for the cure of multiple papilloma of the larynx resulted in marked atrophy of the soft tissues and definite arrest of the development of the larynx. Since these cases were observed some years ago, he was under the impression that they were due to improper application of the therapy. He was therefore surprised to find that bad results are still being seen at a time when one is being led to believe that radiation therapy is safe. It is apparent that all patients who are being treated by irradiation of the neck should be followed closely for several years, not only by the roentgenologist but by the laryngologist. Certainly, consultation with the laryngologist in the first place should be a desideratum.

Dr. Thomas C. Galloway inquired whether Dr. Lukens had any information as to the value of irradiation in cases of carcinoma of the thyroid gland.

Dr. N. M. Lukens, in closing, stated that he had not tried roentgen therapy for carcinoma of the thyroid gland but had been told by roentgenologists that it was indicated. As a matter of fact, he had seen several so-called cured cancers which still showed evidence of progression.

Mucoceles, Pyoceles and Cystic Degenerative Lesions of the Mucous Membrane of the Frontal and Ethmoid Paranasal Sinuses. Presented by Dr. Harold I. Lillie and Dr. C. F. Lake.

Analysis of 44 cases of mucocele, pyocele and cystic degeneration of the frontal and ethmoid sinuses reveals a history of previous infection or trauma, often with subsequent episodes of pain, nasal congestion, occasionally relieved by spontaneous discharge due to rupture, and intranasal drainage. Resorption of bone due to pressure of the growing mass leads to orbital invasion, with diplopia, or to exposure

of the dura. Roentgenograms are helpful in diagnosis, although if the lesion is deep seated it may at times be difficult to differentiate it from a primary orbital tumor. Also, when the mass completely fills the sinus, there will be difficulty in determining its origin. The therapy is surgical, but the approach will depend on whether the cyst is seen before there are any external evidences of it, also on the status of the duct. The latter is not to be disturbed if it is sufficiently patent. In most cases the mass should be removed completely through an external approach.

Lantern slides were presented showing various types of histologic structure, roentgenograms and cysts reconstructed after removal.

DISCUSSION

Dr. Henry M. Goodyear was not in favor of removing the lining of the cyst in any case in which the cyst could be adequately and widely opened through an intranasal operation. The lining in itself constitutes no danger. Recurrence can follow only if the cyst becomes closed off again. Complete resection through an external operation involves the possibility of stenosis of the nasofrontal duct from fibrosis. Dr. Lillie's series of 44 cases included 22 in which the patient had previously been operated on. These cases are naturally difficult and do require radical surgical removal of the cyst.

Dr. W. L. Simpson has had his best results in these cases following extensive resection through an external operation. He removes all the ethmoid cells, cleans out the sphenoid sinus and widens the duct while leaving the middle turbinate bone in situ.

Dr. H. I. Lillie, in closing, stated that he does not see the necessity for removing all the lining of the frontal sinus in the majority of cases, nor does he fined it necessary to remove all the ethmoid cells. Naturally, suppurative cysts fall into a different category. The point is that the surgical procedure must be adapted to the individual case, and cannot in all cases be identical.

Aliphatic Versus Aromatic Amines as Vasoconstrictors. Presented by Dr. K. K. Chen.

Among the benzene-containing or aromatic amines, ephedrine still appears to be one of the best vasoconstrictors. Its methyl group on a carbon atom from amino nitrogen serves as a protector against the action of amine oxidase. This is responsible for the prolongation of action, and the effectiveness by mouth, of ephedrine. The only other product which is comparable to ephedrine is "propadrine." Amphetamine is undesirable because of its stimulating action on the central nervous system. Among the straight chain or aliphatic amines, compounds of 7 carbon atoms have optimal action. Thus, "tuamine" and "fouramine" (2-amino-4-methylhexane sulfate) both have a high potency. Here the methyl group on the atom is again necessary in order to preserve the prolongation of action. A new compound, 2-methylamino-1-cyclopentylpropane, no. 02040, which has a 5-membered ring but also belongs to the aliphatic series, has been shown to be more active than tuamine, fouramine and ephedrine. It is effective by mouth. It has one fortieth of the stimulating action of amphetamine on the central nervous system. Emphasis is placed on oral administration of vasoconstrictors instead of local application. This will rid therapeutics of those products which are not effective by mouth. The synergism of vasoconstrictors and antihistamine drugs is also discussed.

DISCUSSION

Dr. Ernest M. Seydell asked about the habit-forming effects of taking ephedrine by mouth in comparison with its local use.

DR. MARVIN F. JONES inquired about dosage in the same connection.

DR. JOHN J. SHEA was interested in the effect on the blood of long-continued administration of antihistamine drugs.

DR. BERNARD J. MCMAHON inquired about the effect of giving barbiturates in conjunction with the oral administration of ephedrine.

DR. K. K. CHEN, in closing, stated that the habit formation of ephedrine was entirely psychologic because true addiction involves three things, namely: physical dependence, in which the patient suffers on withdrawal of the drug; development of tolerance, in which the dose must be increased, and psychic habituation. Morphine is a good example. Ephedrine habituation is a psychic habit pattern due to the inferiority of the subject. No data have ever been presented to substantiate any theory that ephedrine is habit forming, and that applies even to the psychic aspect. There should be no difference between local and oral administration so far as habit formation is concerned. As far as dose is concerned, Dr. Chen, in his early experiments was guided by the results of animal experiments and had himself taken as high as 150 mg., which is a huge dose compared with those presently used. About 25 mg. three times daily is now considered adequate. Patients who react by becoming jittery should be instructed to lower the amount.

Concerning the antihistamine drugs, he had seen no demonstrable effects on the blood in all the experiments at his laboratory.

The combination of a barbiturate and ephedrine should act well when given at night, since it would protect the patient against insomnia, particularly if he were sensitive.

In response to a query from Dr. Thomas C. Galloway, Dr. Chen stated that the oral administration of ephedrine may be followed by a late turgescence such as is seen some time after its local use.

Responding to another question, from Dr. O. E. Van Alyea, concerning the effect of maphazoline ("privine"), Dr. Chen stated that this drug is constructed entirely differently from the aromatic amines or the aliphatic amines, and that was why he did not mention it in the paper. As to the question "Is there any justification in the requirement of the Government that the label on nose drops of the vasoconstrictor types give warning of possible danger to persons suffering from heart disease, thyroid disorders, diabetes and hypertension?" Dr. Chen said that as long as the manufacturer does not prove conclusively that the agent cannot possibly kill or injure, the notice on the label is required. The law is not perfect. It would perhaps be better if the product were put in the hands of physicians for a sufficient length of time for them to judge its possible side effects before granting clearance for public sale.

Laryngeal Tuberculosis. Presented by DR. E. A. LOOPER.

Comparison of statistics as to the incidence of laryngeal tuberculosis in a series of 3,227 cases during the 1923 to 1928 period, and 5,238 cases during the 1938 to 1948 period, showed a reduction from 15.5 to 11 per cent. This has been due to earlier diagnosis and treatment, particularly to the increasingly popular pulmonary collapse. As a rule, diagnosis is much easier in sanatorium than in general office practice. Otalgia and early cough have been found to be significant. Dysphagia is seen mostly in patients with lesions of the epiglottis and the arytenoids. Dysphonia was seen but rarely. Seventy-six per cent of all patients were female, and most often between the ages of 20 and 40. In the early detection of laryngeal involvement routine laryngologic examinations are necessary in all cases of pulmonary tuberculosis, whether manifest or suspect. It is also important in all

cases to eliminate foci of infection in the nose and sinuses. The therapy comprises general treatment, vocal rest and local therapy. This can best be accomplished in an institution. Locally, cauterization has thus far given the best results. Streptomycin and sulfonamide drugs are helpful and show promise, but sufficient data are not yet at hand for an authoritative statement.

DISCUSSION

DR. BURT K. SHURLY expressed his pleasure in witnessing the improving results of therapy over a period of many years. The incidence of the disease, in his experience, has gone down from 15 to 8 per cent. One hundred patients are now being treated with streptomycin in his institution, and the results obtained with 1 Gm. daily doses have been encouraging. The drug is withdrawn at the first sign of labyrinthine disturbance.

DR. LOUIS H. CLERF emphasized the importance of routine examination of the larynx in all cases of tuberculosis, even when the symptoms are receding. On the other hand, laryngologists need to be on the lookout for tuberculosis in cases in which carcinoma is suspected. In such cases the patient should be referred for a thorough examination of the chest, since frequently the pulmonary condition is quiescent. Also, there is need for revision of textbooks which still harp on the predilection of tuberculosis for the posterior half of the larynx, since Dr. Looper has shown that any part of the larynx may be affected.

DR. FREDERICK A. FIGI showed 3 cases of tuberculosis of the larynx in which excellent results were obtained from daily intramuscular injection of 1 Gm. of streptomycin and inhalation of from 0.5 to 1 Gm., combined in 1 case with penicillin.

DR. HAROLD L. HICKEY has also noted a marked decrease in the incidence of laryngeal tuberculosis in his locality. He agreed that elimination of foci of infection in the mouth and upper air passages was essential, but called attention to the danger of surgical intervention in cases in which pulmonary tuberculosis was not arrested. He has seen the development of laryngeal tuberculosis closely follow tonsillectomy in such an instance.

Concerning vocal rest, it is imperative that at the same time general body rest be enforced. Even flexing of the pectoral muscles has been shown to affect the glottis.

DR. FREDERICK T. HILL called attention to the importance of eliminating non-tuberculous lesions in tuberculous patients. A case in point was that of a young man with active tuberculosis, who complained of fulness in the throat, soreness and some dysphagia. Examination revealed a marked lingual thyroid, the removal of which was followed by relief of the local symptoms.

DR. DANIEL S. CUNNING commented on the rarity of primary tuberculosis of the larynx, having recently observed a case in which roentgen examination, serologic tests and other procedures all failed to reveal any pulmonary involvement.

DR. E. A. LOOPER, in closing, stated that he had never encountered a case of primary tuberculosis of the larynx.

Moniliasis of the Larynx. Presented by DR. CLAUDE C. CODY.

Monilia is classified between a true mold and a yeast. It is difficult to differentiate moniliasis from blastomycosis, and the two are very similar as to course. It is more important to differentiate moniliasis from carcinoma and tuberculosis of the larynx. Two cases are reported. One of the patients was a woman of 48 and the other a man of 54. The symptoms were pain, cough, dysphagia and hoarseness. Locally, papillomatous masses, fixation of a vocal cord and infiltration were

noted. Also, roentgenograms of the chest showed diffuse moniliasis on both sides. The organisms were recovered on slides and in culture. Streptomycin and strong solution of iodine U. S. P. cleared the lesions.

DISCUSSION

DR. JOHN J. SHEA reported 2 cases, in 1 of which the patient succumbed. He agreed with Dr. Cody that roentgenograms of the chest frequently reveal bilateral fungous invasion of the bronchi, as in his own cases, in 1 of which the pharynx was also involved. Iodides, thymol, cod liver oil and sodium benzoate were given for more than a month before streptomycin was tried. He emphasized the importance of the roentgenograms of the chest because it takes two to three weeks to obtain a diagnosis by culture.

DR. THOMAS C. GALLOWAY asked whether Moniliae are primarily pathogenic or saprophytic, and whether their activity depends on some systemic condition.

DR. C. C. CODY, in closing, stated that the literature would indicate that many of the Monilae do not seem to be pathogenic. Monilia albicans in connection with some pyogenic type of infection becomes of itself an invading organism. However, the situation with regard to moniliasis of the larynx is similar to that of otomycosis, since mycologists are still at odds over the question as to whether a pure fungus infection is pathogenic. This is due to the fact that in both cases a pure infection is the exception rather than the rule.

Rhinoscleroma Apparently Cured with Streptomycin. Presented by DR. GORDON B. NEW.

Rhinoscleroma is on the increase in this country, as evidenced by a recent report in which 200 cases had been collected. Dr. New discussed the pathogenesis of the disease and described the typical lesions.

His case was that of a woman of 32, born in Siberia, whose symptoms dated back fifteen years, having been diagnosed first in China. When she was seen at the Mayo Clinic the nares were closed, the pharynx was scarred and the epiglottis and the larynx invaded, with some subglottic obstruction. Tracheotomy was performed, and biopsy of a specimen revealed that the lesion was rhinoscleroma. The bacteria were tested for streptomycin sensitivity. The drug was then given at the rate of 250 mg. every three hours; after seven days its administration was discontinued because of pains of the joints and malaise, but later was resumed. After 53 Gm. had been given, the airway was definitely widened. After 95 Gm. had been administered, the biopsy specimens were negative for the organisms. Vestibular disturbance was noted, which diminished after four months. The patient was followed for over a year, at which time the biopsy specimen still showed no bacilli of rhinoscleroma. The contraction of the nares was corrected by a graft, with subsequent use of a stent. Ten months later the airway was still good. The tomographs in this case were instructive.

DISCUSSION

DR. DANIEL S. CUNNING recalled his report to this association last year of rhinoscleroma observed in two native-born brothers. One has died in the meantime. Since hearing of the efficacy of streptomycin he has employed it in the treatment of the other for nine months at the rate of 1.5 Gm. every twenty-four hours. However, aside from clearing up the secondary infection, the drug seemed to have had little influence on the lesions, which looked the same as they did before the administration of streptomycin was started.

DR. WILLIAMS reported on the use of streptomycin by inhalation as practiced by his associate, Dr. K. M. Symonton, in cases of ozena. Culture showed Klebsiella associated with Pseudomonas. Although initial improvement was noted, the infections relapsed because the organisms had developed marked resistance to the drug. Dr. Williams wondered whether the good results obtained by Dr. New, contrasted with the poor results in the cases of ozena, were not due to the larger doses given parenterally, contrasted with the smaller doses administered by nebulization.

DR. HENRY M. GOODYEAR inquired of Dr. Williams whether he had tried streptomycin hypodermically in any of his cases of ozena. Dr. Williams replied he had not.

DR. G. B. NEW, in closing, commented on the failure of the drug in Dr. Cunning's case, which was probably due to the fact that the germ was not streptomycin sensitive in that instance. It is important that sensitivity tests be conducted on cultures of material taken from the patient before it is decided to use the drug.

Dr. New was acquainted with the work done by Dr. Williams and Dr. Symonton in the study of ozena. However, in his own case, knowing that he was dealing with a Klebsiella that was sensitive, he hit it hard and consistently, which may have accounted for the favorable outcome.

Cancer of the Larynx. Presented by DR. LE ROY A. SCHALL.

Dr. Schall presented an analysis of 500 cases of carcinoma of the larynx seen at the Massachusetts Eye and Ear Infirmary. Of the patients, 418 were treated and traced; the remainder were studied for diagnosis only, or were refused treatment or were not followed. Ninety-two per cent were men at an average age of 60. Of the women the average age was 40. Pathologically, 35 of the cancers were rated grade 1, 210 grade 2 and 140 grade 3. As to therapy, 246 patients were given external application of roentgen rays, 14 treatment by radium and 158 were operated on. The percentage of cures following radiation therapy was fairly constant in three series of cases analyzed in the periods 1930 to 1935, 1935 to 1940 and 1941 to 1945, averaging 25. Enthusiasm for high voltage radiation accounts for the large number of patients thus treated. Dr. Schall emphasized the following points in this connection: (1) Hopeless cases are not good for radiation therapy; (2) regression is not a cure; (3) the trial period of irradiation is a fallacy.

Cordal lesions are ideal for laryngofissure. Eleven lesions thus treated showed 27 per cent failures; 46 per cent were cured for five years or more and 27 per cent were healed but had been observed for less than five years. The operation is indicated in local lesions limited to the anterior or the middle third without fixation. All others should be dealt with by laryngectomy. Their five year cures in 63 cases numbered 30 per cent. Laryngectomy after irradiation was less successful, only 2 of 8 patients surviving for the five year period.

DISCUSSION

DR. LOUIS H. CLERF was impressed by the large number of patients who had received irradiation of their lesions. It has been his experience that the results from this form of therapy seem to be getting progressively worse. Since the radiologist claims his best results in the very group in which experience has proved that laryngofissure is eminently successful, Dr. Clerf feels that their results have not supported their contention. As to the decision between thyrotomy and laryngectomy, one cannot be too careful. Unless the indication for thyrotomy is clear, one had better advise laryngectomy because it offers more to the patient than other plans of therapy. While some larynxes may be sacrificed, more patients will be

saved. In this connection it is well to remember that one must be radical. Conserving some of the structures attached to the larynx which may harbor cancer cells is a mistake. It has been his practice in some cases to do a block dissection at the same sitting, and the results have justified this procedure.

Dr. John D. Kernan recalled his early experiences with laryngectomy as developed by Dr. McKenty and is gratified with the progress achieved in the technic during the past thirty-five years. Yet, despite the good results being obtained, one cannot forget that without a larynx the patient is in some respects a cripple. This naturally accounts for the hedging that takes place when borderline lesions come under observation.

The histologic picture is important and only those lesions of the lowest malignancy should be treated by a laryngofissure. Cancers which have a similar appearance can turn out very differently. The speaker can recall a patient whose cancer was so extensive that it was sprouting out around the tracheotomy tube. To get about this growth it was necessary to remove the whole thyroid gland and do a complete dissection of the neck on both sides. The patient is living twenty-five years after operation. On the other hand, a patient, with a cancer with a gross appearance similar to this but with a more malignant histologic picture died one month after a similar operation with extensive recurrence.

Dr. Chevalier L. Jackson agreed with Dr. Schall as to the indications for thyrotomy. If these are strictly adhered to, the five year cures will easily reach 85 to 90 per cent. As to irradiation, he was not entirely clear about the indications. Commenting on Dr. Kernan's observations, he too had seen cases in which it was difficult to delineate the exact boundaries of a lesion. When this difficulty is encountered during the performance of laryngofissure, one had better not carry it through. There are cases in which the extension is submucous and cannot be detected with the naked eye.

As for grading, his experience coincided with that of Dr. Schall, namely, that grades 1 and 2 give the best results both on surgical treatment and on irradiation, whereas grades 3 and 4 are less favorable.

Dr. H. W. D. McCart, acting as consulting laryngologist to the Radium Clinic in Toronto, Canada, has come to the conclusion that the early good results are not always lasting when the cases are observed over a period of years, and fall short of those obtained by surgical procedure. Another important point is that if a patient with a lesion favorable for thyrotomy is treated by irradiation unsuccessfully, the patient must then undergo laryngectomy. Thus a minor procedure is converted into a much more serious major operation. Furthermore, the results in such cases are not nearly as good as those in which no radiation therapy had been given.

Dr. Edwin N. Broyles commented on the cases in which preliminary tracheotomy was necessary, it being his impression that in such cases the carcinoma has already extended beyond the intrinsic field.

Dr. J. M. Robison recalled an article by Dr. Rolls, of the Rockefeller Institute, dealing with the virus theory in connection with carcinoma. He was impressed with the statement that tissues must be conditioned for cancer to occur. This conditioning may occur as a result of irritation from smoking, drinking, infection or serologic or chemical alterations in the body. If the tissue needs to be conditioned for the development of cancer, when the cells migrate into tissue that is not conditioned, they seem to have a proclivity for conditioning these new areas. The reaction to therapy differs in these two instances. Often the new area will clear up under irradiation, whereas the original nidus will resist this therapy and can be cured only by radical excision.

DR. L. A. SCHALL, in closing, stated that in his clinic radiologists are in complete harmony with the surgeons and defer to the latter on all controversial issues. Concerning grading, Dr. Schall has little confidence in its value as indicating the type of therapy and can say only that the best results are obtained in cases of grades 1 and 2. As to indications for advising irradiation, Dr. Schall would recommend it for the patients whose voice is absolutely essential to their vocation and whose cancerous growth is limited. Also, the patient must consent to be under constant observation for an indefinite period following the treatment. Too many tragedies have occurred in cases in which the patient wandered away from the clinic where he was treated.

Carcinoma of the Trachea. Presented by DR. C. W. ENGLER.

Dr. Engler reported 2 cases of carcinoma of the trachea. In one case the symptoms of cough and bloody expectoration led to fluoroscopic and bronchoscopic examinations, which revealed a mass in the trachea near the bifurcation. This mass cleared up completely after irradiation but recurred two years later, and another appeared below the glottis. Radiotherapy was again applied, but the result is not yet decisive.

In the second case the lesion was far advanced when first seen, causing so much obstruction as to necessitate an extended tracheotomy with an especially long tube to pass the lesion. Roentgen therapy was of little avail, and autopsy revealed that the carcinoma had extended into the esophagus and the peritracheal tissues.

Since Culp's review of the subject, in 1938, the author had been able to collect only 35 to 40 cases from the literature. He made a plea for more thorough roentgenologic study of suspected cases in addition to early bronchoscopic investigation. A number of five to ten year cures were cited. Also, Dr. Engler discussed the histopathologic aspects of carcinoma of the trachea, including those of cylindroma, concerning which there is some difference of opinion.

DISCUSSION

DR. EDWIN N. BROYLES recalled having reported 2 cases of carcinoma of the trachea. One patient was kept going for eleven years by repeated fulguration of the involved region. Another seemed hopeless and was given roentgen therapy, which had little effect. Autopsy showed that the lesion, though extensive, was quite superficial and might have yielded to the therapy that was used in the first case. This emphasizes the importance of good roentgenologic studies to determine the depth of the invasion.

Report of the Postoperative Course in Cases of Subperichondral Total Laryngectomy. Presented by DR. EDWIN N. BROYLES and DR. E. M. WALZL.

The subperichondral technic advised by Crowe and Broyles has been used in performing total laryngectomy on a number of carefully selected patients with intrinsic carcinoma of the larynx. The postoperative course in the last 28 consecutive cases is reviewed and the use of chemotherapy and some modifications of the technic of the operation are discussed. The modifications are: (1) the use of mucous membrane from the dorsal surface of the epiglottis for obtaining a complete mucous membrane closure of the pharyngeal defect resulting from removal of the larynx, and (2) the local use of tyrothricin and sulfathiazole in the wound to prevent infection from contamination by secretions of the mouth. By the use of these modifications of technic, an almost completely uneventful postoperative course was

obtained in all cases. In the cases reviewed, there was no wound infection, no shock and no fistula formation. None of the patients required a feeding tube. The usual stay in the hospital was one to two weeks. The postoperative course of these patients is compared with that of a group in which no chemotherapy was used. It is concluded that when local chemotherapy is employed, the danger of wound infection from contamination by mouth secretions is unimportant, and that the operation as described reduces to a minimum postoperative complications and greatly shortens the recovery period.

DISCUSSION

Dr. Louis H. Clerf said that the indications for this procedure must be well circumscribed because of the hazards of leaving the ribbon muscles and the perichondrium, in which undetected nests of cells might be hidden.

Dr. LeRoy A. Schall pointed out that the utilization of the mucous membrane of the epiglottis was first advocated by Dr. Harry Barnes about fifteen years ago and had been employed by himself in 6 cases. However, in all 6 cases a recurrence developed. Consequently, Dr. Schall has given up this procedure.

Dr. James M. Robb asked the essayists to comment on the matter of recurrence.

Dr. E. M. Walzl stated that in the cases in which recurrence was noted it occurred in the region of the cricothyroid membrane and that really these cases were originally unsuited for the operation. Usually recurrence was late, up to five years, in probably between 65 and 70 per cent.

Dr. Jack McNaughton suggested that the operation might well be indicated in the borderline case in which thyrotomy would be doubtful and yet laryngectomy too radical. He employed this procedure in 10 cases and found that since the weak point in the closure is where the pretracheal muscles fail to lap over, just above the stump of the trachea, the wound would heal better if the incision of the skin veered away from the midline at this junction, thus affording a good skin flap. He asked Dr. Walzl as to the suture material used in the tracheal mucosa.

Dr. E. M. Walzl, in closing, said he used triple 0 catgut. He agreed with Dr. Clerf that the indications for the operation were restricted and he certainly would not advise it if there were the least suggestion that the growth had extended into the preepiglottic space.

Book Reviews

Detailed Atlas of the Head and Neck. By Raymond C. Truex, M.S., Ph.D. associate professor of anatomy, College of Physicians and Surgeons, Columbia University, and Carl E. Kellner, artist, department of anatomy, College of Physicians and Surgeons, Columbia University. Price, $15. Pp. 162, with 136 illustrations, mostly in color. Indexed. New York: Oxford University Press, 1948.

For many years "visual education" has been a trite phrase on the lips of many a teacher ,but educators are just beginning in these post-War II days to grasp the full meaning of it. The modern lantern, colored slides, moving pictures, stereoscopic representations, the "off-set process" and other devices—all these have helped to make the hard road of the medical student easier to travel. As for anatomy, instructors used to rely entirely on the figures and texts of Gray, Cunningham and others, most of which were in black and white. For colored plates they were glad to have those of Spalteholtz or some other "foreign" work. All of these helped pave the way for better visualization and comprehension, but students and teachers are no longer dependent on anybody or anything beyond the confines of the United States. Technology has reached almost the peak of perfection, and more and better teaching can be done here because there are now highly trained workers in all fields who are able and willing to teach.

This atlas of the anatomy of the head and neck is probably a precursor of what one may yet expect for the entire human body. The dissections offered by Dr. Truex are indeed "detailed" to the highest degree, and the artistic representations by Mr. Kellner are not only exceedingly exact but beautiful to look on. In Dr. Detwiler's phrase, one has here the work of two great students operating "in a state of true symbiosis." (Dr. Detwiler is professor and chief of the department of anatomy in the College of Physicians and Surgeons, New York.)

The Introduction, by E. A. Boyden, of the medical school of the University of Minnesota, states that the originality displayed in the sequence and the character of the dissections used in presenting a series, which can be analyzed and easily remembered, is significant. He cites the dissection of the anterior triangle of the neck in figure 12 as "the thyroidectomy approach." This enables one to follow the visceral and vascular columns, and associated nerves, into the thorax. Beginning with figures 17 and working through to figure 26, the student has before him the parotid space (site of myxoma), leading to the retromandibular area, then the pterygoid muscles and the structures flowing through them like an archway, then the parapharyngeal area, not well understood by many undergraduate students, and finally, under the mandible, the relations of hyoglossus muscles so important in operating on the tongue. For many otorhinolaryngologists, the middle fossa of the skull and its contents, especially the temporal bone, are not readily understood. Here the anatomy is made plain by figure 54, which shows the middle fossa and the petrous bone, which when sectioned horizontally discloses the labyrinth, the tympanic cavity and the internal and middle ear in juxtaposition. In the view taken from above one has the left cavernous sinus and the tympanic cavity, the right infratemporal fossa and the right bony labyrinth. The courses of the auditory, facial and chorda tympani nerves are well shown in their true relationship to other structures. Noteworthy

too is the splendid exposure of the orbit with the eyeball in situ. Every muscle and nerve is seen in its anatomic position, and all blood vessels are fully presented. Figure 65 and following illustrations show the anatomy of the pharynx and larynx seen anteriorly and posteriorly, superiorly and laterally. The neuroanatomy is especially well illustrated. In fact, the neurologist can profit greatly by the enormously detailed exposure of all nerves in the areas mentioned. The anatomy of the cerebrum and the cerebellum is well described in text and figures. Sections of the gross anatomy of both head and neck are viewed vertically and horizontally in series, so that a complete understanding of all anatomic relationships can be easily made out. Here is a work which holds an exceedingly high standard before any subsequent attempts to delineate the anatomy of one of the most difficult regions of the human body. All praise to these indefatigable workers who have contributed this magnum opus.

Ophthalmology of the War Years. Edited by Meyer Wiener, M.D. Volume 2 (1944-June 1946). Price $16. Chicago. The Year Book Publishers, Inc., 1948.

As did the first volume, which covered the period 1940 to 1943, this second volume reviews the articles and case reports in the field of ophthalmology for the benefit of those who were on war service at the time the material was published. Thirty-three subjects, from anatomy and embryology to diseases of the uveal tract, are presented by an equal number of associate editors. A chapter dealing with the effects of agents of chemical warfare on the eye, which did not appear in the first volume, is now introduced.

While the book is intended primarily for the ophthalmologist, there are two chapters of great interest for the otolaryngologist: "Orbit, Eyeball and Sinuses," and "Relationship of the Eye to the Ear, Nose and Throat." Here one finds it reported that most cases labeled orbital cellulitis are in reality acute frontal sinusitis or acute ethmoiditis with orbital edema; that in iridocyclitis of obscure origin the focus of infection is more often in the tonsils than in the sinuses; that in 50 per cent of a series of 75 patients with associated nasal and conjunctival inflammation cultures from both sites revealed organisms similar in type and toxicity.

The relationship of ipsilateral glaucoma and sinus or nasal disease, discussed in the first volume, is treated further in the second. The theory is suggested that the connecting link is reflex irritation of the vasomotor apparatus controlling the circulation of the orbit. There has been lowering of intraocular tension after cocainization of the region of the sphenopalatine ganglion. Others report prompt relief of pain and rapid healing of corneal ulcers after such cocainization and attribute this result to a block of vasomotor spasm of the circumcorneal vessels. Retrobulbar neuritis also seemed benefited by this procedure.

The approach to current medical literature utilized in this volume and in its predecessor makes for stimulating reading. In many cases greater detail would be desirable, but a complete bibliography is provided at the end of each chapter for those who seek further development of any of the topics.

The Lung. By William Snow Miller, late emeritus professor of anatomy, University of Wisconsin. Second edition. Pp. 222, with 168 illustrations, some in color. Price, $7.50. Springfield, Ill.: Charles C. Thomas, Publisher, 1948

As the author states, there is no great difference between this and the first edition, which found a place of value in medical literature. There are some

additional illustrations in chapters 4, 6 and 9. Professor Larsell has studied the nerves of the visceral pleura, the results of which are set down in chapter 9. Particular emphasis is laid on the structure of the lung; for on this basis its diseases may be studied, and rational treatment instituted. The author again states that the lung is lined (the alveoli) by epithelium, although some other authorities disagree. A bibliography containing some 255 references is noteworthy, taken from Latin, German, French and Italian literature as well as English and American. The direct tube specialist will be interested particularly in the matter relating to the lymphatic channels and lymph nodes of the trachea and the bronchi. Of the tubuloacinous type, they are placed in the submucosa and are more abundant in the anteior wall of the trachea than in the lateral wall. This may explain the distressing "itching and scratching" of tracheitis so often felt at the episternal notch and associated with a dry, hard, nonproductive cough. Bacteria which invade this tissue have an almost impregnable stronghold, and, therefore, tracheitis may go on and on for weeks! In chapter 10 the author describes five "keypoints" where certain structures are constantly found. They have to do with radicles of the pulmonary vein, the distal end of a ductus alveolaris and "the place where a bronchus or a bronchiolus divides." There is also a "transitional zone" in which tubercles are most likely to develop. "Possibly a retardation of the circulatory force at this point may be a determining factor."

News and Comment

GEORGIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

The annual meeting will be held at the General Oglethorpe Hotel, in Savannah, March 4 to 5, 1949.

The distinguished lecturers and their tentative subjects are: Dr. Paul A. Chandler, of Boston, "Glaucoma Management"; Dr. Jack S. Guyton, of Baltimore, "Cataract Management"; Dr. Oscar C. E. Hansen-Pruss, of Durham, N. C., "Allergy of the Upper Respiratory Tract"; Dr. Marvin F. Jones, of New York, "Management of Ear Problems in Children and an Otological Survey"; Dr. Ralph O. Rychener, of Memphis, Tenn., "External Eye Diseases and Dacryocystitis"; Dr. Fletcher D. Woodward, of Charlottesville, Va., "Problems in Laryngology."

Directory of Otolaryngologic Societies *

INTERNATIONAL

Fourth International Congress of Otolaryngology

President: Dr. V. E. Negus, London, England.
General Secretaries: Dr. F. C. W. Capps and Dr. W. A. Mill, 45 Lincoln's Inn Fields, London, W. C. 2.
Place: London. Time: July 18-23, 1949.

Second Pan-American Congress of Oto-Rhino-Laryngology and Bronchoesophagology

President: Prof. Justo Alonso.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.
Place: Montevideo. Time: January 1950.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Henry B. Orton, 224 Delavan Ave., Newark, N. J.
Secretary: Dr. J. Milton Robb, 1553 Woodward Ave., Detroit, Mich.
Place: Atlantic City, N. J. Time: June 6-10, 1949.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Conrad Berens, 35 E. 70th St., New York.
President-Elect: Dr. J. Mackenzie Brown, Box 584, South Laguna, Calif.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.

American Broncho-Esophagological Association

President: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Secretary: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore.
Place: Drake Hotel, Chicago. Time: April 18-20, 1949.

American Laryngological Association

President: Dr. Frederick T. Hill, 177 Main St., Waterville, Maine.
Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia 2.
Place: Biltmore Hotel, New York. Time: May 16-17, 1949.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. John J. Shea, 1018 Madison Ave., Memphis, Tenn.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Drake Hotel, Chicago. Time: April 18-20, 1949.

SECTIONS:

Eastern.—Chairman: Dr. Harold G. Tobey, 403 Commonwealth Ave., Boston.
Southern.—Chairman: Dr. Watt W. Eagle, Duke University, Durham, N. C.
Middle.—Chairman: Dr. Dean M. Lierle, University Hospital, Iowa City.
Western.—Chairman: Dr. Leland G. Hunnicutt, 98 N. Madison Ave., Pasadena, Calif.

American Otological Society

President: Dr. Marvin F. Jones, 121 E. 60th St., New York.
Secretary: Dr. Gordon D. Hoople, Medical Arts Bldg., Syracuse 3, N. Y.
Place: Biltmore Hotel, New York. Time: May 18-19, 1949.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Samuel F. Kelley, 47 E. 61st St., New York 21.
Secretary: Dr. Norman N. Smith, 291 Whitney Ave., New Haven 11, Conn.

American Society of Ophthalmologic and Otolaryngologic Allergy

President: Dr. Rea E. Ashley, 384 Post St., San Francisco.
Secretary-Treasurer: Dr. Joseph Hampsey, 806 May Bldg., Pittsburgh 22.

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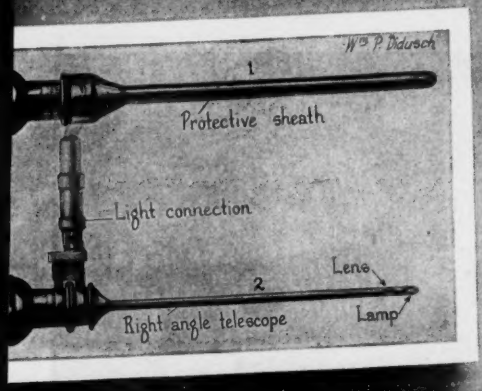
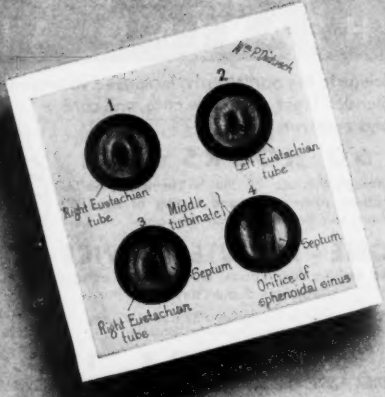
* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.





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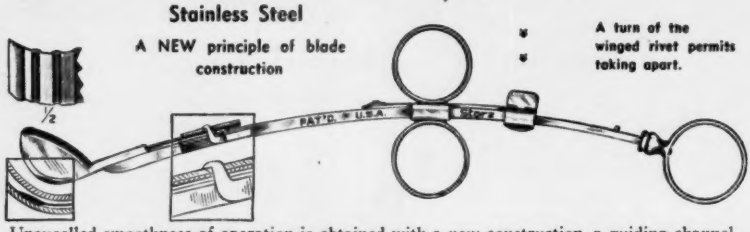

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